A COMPUTER ASSISTED GAME FOR TRAINING ARMY CORPS COMMUNICATORS

by

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United States
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THESIS

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FOR
TRAINING ARMY CORPS COMMUNICATORS

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Alexander Joseph Fox

April 1970

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A Computer Assisted Game

For

Training Army Corps Communicators

by

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ABSTRACT

This thesis presents a computer assisted game, based on a current map board exercise at the U. S. Army Signal Center and School, designed to train army officers in the capabilities, organization, and deployment techniques of the Corps Signal Battalion. A team of players using the game direct a simulated signal battalion in a European tactical environment experiencing equipment failures, vehicle failures, and site attacks. The decisions made by the players are similar to those in combat and are entered by means of a remote computer terminal. These decisions include installing and deleting communications systems, connecting and disconnecting equipment, moving vehicles, and establishing communications sites. The computer, acting in the roles of battalion communications personnel, nature, and the enemy, informs the players of its actions by means of the same terminal.

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I. INTRODUCTION

An army corps is a tactical organization larger than a division and smaller than a field army. It consists of a tactical headquarters capable of controlling from two to seven divisions and auxiliary arms and services. The actual number and type of divisions assigned to a given corps is tailored to accomplish a specific mission and will vary significantly with the mission. The administrative and logistical support provided by the corps is minimal with primary responsibility for these tasks assigned to the field army and divisions.

One factor necessary for efficient operation of a corps is an effective tactical communications system. The basic requirement of this system is the support of the units combat operations. To satisfy this requirement the system must provide rapid, reliable, secure interchange of information and orders within and between echelons of the headquarters it serves and to major subordinate units. The size of the corps organization requires that the communications system be large and complex - involving many different types of equipment located throughout the corps area of operations.

The communications are provided for a corps by both an organic signal battalion and field army signal personnel. The Command Communications System, a system linking only major corps and subordinate headquarters, is provided by the Corps Signal Battalion. Field army signal personnel provide an Area Communications System which serves both as a backup to the Command System and a means for providing communications for units not served by the other system.

The size and complexity of the communications needed to support a corps requires highly trained signal corps personnel to plan and operate the communications systems. Providing these personnel is a continuous problem due to frequent assignment changes, limited training time and funds, and the need for diversity in assignment for signal corps officer At the present time instruction in corps communications doctrine and techniques is given primarily in a number of signal corps Military Occupational Speciality (MOS) courses and the Signal Officer Advanced Course. In this instruction the capabilities and limitations of the equipment available are discussed as well as the standard techniques of employment. In the Signal Officer Advanced Course considerable time is spent with a map board exercise in an effort to play a tactical scenario which introduces, and presents proposed solutions to, some of the problem areas encountered in the field.

The optimal method of training officers in corps communications is achieved by field exercises in which the student actually participates in a dynamic training exercise and experiences first hand the problems which arise. Unfortunately this method is not practical when the large number of officers to be trained is considered. Field exercises are time consuming, extremely expensive, and are capable of training only a small number of officers with each exercise.

Map board exercises on the other hand take less time, are relatively cheap, and by training many table groups at one time are able to accommodate a sizable number of officers. There are many problems, however, associated with map board exercises. Typically, requirement or problem sheets are distributed to a large number of table groups and the groups are then given enough time to arrive at solutions. When the group solutions are formulated the instructor presents the "school solution" and the groups compare their results to it. Unfortunately the requirements usually have many acceptable solutions and the group differing from the school solution is frequently unsure of the merits of its result. Since the exercise usually proceeds at the pace of the slowest table there is considerable wasted time. Complex interrelationships present in operational units and field exercises are impossible due to the manual bookkeeping that would be required. As a result of the relatively simple, clean problems necessary for this type of teaching one or two members of the group typically perform the bulk of the work leaving the other two or three members little to do resulting in little benefit to them.

The purpose of this thesis is to present a computer assisted game for use as a teaching vehicle to supplement and partially replace current map board exercises used in corps communications instruction. The game allows the players to simulate the deployment and operation of a Corps Signal Battalion in a tactical scenario facing problems similar to those in a combat operation. The use of the computer allows a dynamic, realistic approach to learning which includes equipment failures, vehicle movement, sites attacks, and detail in scenario and player response not possible in manual map board exercises. Wasted time is drastically reduced since the game proceeds at the pace of the single group using it.

Although the program was developed primarily for use as a teaching vehicle it might also be used for evaluating new corps communications techniques and proposed changes in doctrine. By employing the game a large number of times using the proposed change in doctrine a representative outcome may be obtained and this outcome compared to that using current doctrine. The sensitivity of various proposed doctrines to changes in the level of conflict may also be examined by changing internally stored parameters.

The game was constructed in a general form to allow it to be easily converted to signal units other than the Corps Signal Battalion (e.g., Division Signal Battalion, Airborne Corps Signal Battalion). Other possible applications are varied and include such diverse areas as power transmission and transportation problems. Other applications are covered in more detail in a later section of this thesis.

II. DESCRIPTION OF THE GAME

A. GENERAL

The computer assisted game developed for this thesis allows a group of four to seven students playing it, under the supervision of an instructor, to act as planners and operational decision makers for a Corps Signal Battalion area of operations in a hypothetical Western European campaign. The scenario used in the game is the same as one currently being employed in the Signal Officer Advanced Course at Ft. Monmouth, New Jersey and is considered mid-intensity. A description of the tactical scenario used is included in Appendix B.

It is assumed in this section that the reader is familiar to some extent with the organization and employment of the Corps Signal Battalion. A short description of the Corps Signal Battalion is given in Appendix A and more detailed information is available in References 2 to 4 of the Bibliography.

During the course of the game the computer plays three different roles - signal battalion personnel, nature, and the enemy. It acts as signal battalion personnel when it implements the instructions given to it by the players. It performs the role of nature when it introduces equipment failures based on the actual failure distributions of the individual items of equipment. Finally it simulates the enemy when it introduces site attacks and subsequent equipment damage.

The team of players, on the other hand, attempt to make optimal use of the equipment organic to the Corps Signal Battalion by intelligent initial equipment placement and equipment change commands during play.

Placement and changes made by the players are similar to those encountered by a signal battalion in the field. All computer introduced actions are reported to the players by messages typed on a remote teletype terminal attached to the computer. Likewise player commands are transmitted to the computer by means of the same terminal.

The play of the game is divided into two phases - a setup phase and a free play phase. The following sections describe each of these phases in some detail.

B. SETUP PHASE

In the setup phase the players study the tactical scenario, which is basically a corps in the defense preparing for resumption of the attack, and choose locations for the communications sites and major items of communications equipment. They then order communications installed between the sites.

1. Site Input

The players choice of site locations is based primarily upon the location of the major corps and subordinate headquarters they must provide communications for and the terrain of the area of operation. They must choose the site location close enough to the supported headquarters to be able to provide communications for them but the location must also have radio line-of-sight if certain communications equipment is to be used.

When players enter each site location with its grid coordinates the computer compares the location to that of the major corps and subordinate headquarters. If the site is sufficiently close to a headquarters to provide communications support it is automatically assigned as a site supporting that headquarters. If it is not sufficiently close to a major headquarters it is classified as a radio relay site.

Because of the different equipment types usually employed at corps main, alternate, and artillery headquarters a greater distance is allowed between these sites and supported headquarters. A maximum of thirty sites may be located.

2. Systems Input

Once the communications sites are located the players order communications systems established between them. Three types of systems are possible - multichannel cable, radio relay, and high frequency. Each multichannel cable and radio relay system is capable of transmitting twelve voice circuits while the high frequency systems transmit only one per system. The number and type of systems between the sites is determined by communications doctrine, player judgement, terrain, and equipment limitations.

3. Communication Vehicle and Generator Placement

In order to provide communications equipment to establish the systems which have been ordered installed the players next distribute the communications vehicles and generators organic to the battalion among the sites in the corps area. This placement includes vehicles used for backup as well as those needed for system installation.

Four types of communications vehicles are located in addition to generators:

(1)	AN/MRC-103	(Radio Repeater)
(2)	AN/MRC-102	(Radio Terminal)
(3)	AN/MCC-6	(Telegraph-Telephone Terminal)
(4)	AN/GRC-26	(Radio Terminal)

When this data is entered the computer has enough information to assign individual radios and multiplexers to the systems ordered installed. Since the communications planner in the field who is concerned with the overall corps communications picture normally does not determine which of the individual items of equipment in the vehicles are used on particular systems (this is left to site operating personnel) the game does not require this detailed information. In assigning equipment to systems the game uses the same logic a site operator would use as to choice of vehicle type, number of spare pieces of equipment for each vehicle, etc. The Program Construction section of this thesis discusses the equipment assignment proceedure in more detail. If the players did not place enough equipment at a site to establish the ordered systems a message is printed at the terminal informing them of the site number where the problem occured and the system type. All equipment is considered operational for the setup phase of the game.

Upon completion of the setup phase a master table of equipment placement and systems for each site is printed as well as a table giving generator location and status. Since these tables are lengthy they are printed offline on a high speed printer. Appendix D gives a typical printout of these tables for a sample equipment placement.

C. FREE PLAY PHASE

When the initial input is entered by the players and the detailed assignment and checks are performed by the computer the game enters the free play phase. In this phase the players react to a simulated campaign by experiencing problems and making decisions similar to those in the field. The computer acting as nature and the enemy introduces communications equipment failures, vehicle failures, repairs of failed items, and site attacks resulting in damaged or destroyed equipment. The players respond to the computer introduced messages by disconnecting and connecting equipment on systems, deleting old systems and installing new ones, moving vehicles, and establishing new sites.

1. Computer Introduced Actions

The players are notified of all computer introduced actions by messages printed at the teletype terminal. A brief description of these actions follows in this section with more detailed information available in the Program Construction Section.

a. Communications Equipment Failures

Communications equipment failures occur on the major items of communications equipment located throughout the battalion. These include radio AN/GRC-50, radio AN/GRC-26, and multiplex AN/TCC-7. Times to failure for each item of communications equipment above is assumed to be distributed with a truncated normal failure distribution.

During the setup phase each piece of communications equipment is assigned a number of minutes of operation until its first failure. When this time is reached the equipment fails and the players are notified. Only equipment which is connected to a system is allowed to fail since it is assumed that all others are on standby. Likewise the number of minutes until failure for a piece of communications equipment is strictly minutes connected to a system.

Although it is assumed that all equipment is operational when the game enters the Free Play Phase it is not assumed that all equipment is newly repaired. To allow for this the first failure times are sampled from an approximation of the equilibrium distribution of the truncated normal failure distribution associated with the item. Subsequent failure times for the same item are sampled from the truncated normal failure distribution itself.

When the equipment fails the system to which it is connected must become non-operational if it was operational prior to the failure. If the equipment causes a system failure the players are notified of this event by a message.

Since a signal battalion in the field has the means to repair most failed items of equipment provision was made in the program for repair. As soon as an item fails a time for repair is determined by taking a sample from a truncated normal repair time distribution for the appropriate type of equipment. This actual time for repair provides a basis for providing the players with an estimated time of repair. By using the actual repair time as the mean of another distribution the player is provided with a printed estimate.

b. Communications Equipment Repair

Communication equipment repairs occur on the same items of communications equipment as failures. When the time for repair, determined when the item failed, has elapsed the players are notified that the equipment is again operational. If the equipment is still connected to a communications system the system is checked to determine if it can now become operational. If it can the student is notified that the system is working.

c. Generator Failure and Repair

Generator failure times are computed in a manner similar to communications equipment failures. Since generators are assigned to sites and not to specific systems, however, all generators are assumed used and subject to failure. As in communication equipment failures a repair time is established and the players are provided with an estimate of this time. Similarly, when the generator is repaired the players are notified of the event.

d. Vehicle Failure

The four types of vehicles placed in the Setup Phase are allowed to fail in the Free Play Phase. A failure for a vehicle implies that a mechanical breakdown has occurred and it is assumed that these happen only during transit.

A failure time (in km of road distance traveled until scheduled failure) is generated for each of the vehicles during the Setup Phase of the game from the equilibrium distribution associated with each vehicle type. A truncated normal distribution is again assumed to be the failure distribution of the vehicle type. The second and subsequent failure times for a vehicle are sampled directly from the assumed truncated normal distribution.

When a failure occurs a time until repair (in minutes) is calculated from a repair distribution and the vehicle is considered repaired after this amount of time has elapsed. An estimate of the time for repair is provided for the players when the vehicle failure message is printed.

e. Vehicle Repair

Vehicle repairs are effected for failed vehicles when the time for repair described above has elapsed. When a vehicle is again made operational the players are notified and the vehicle continues its simulated trip to the ordered destination.

f. Site Attack

Signal sites are an effective command and control instrument of the corps commander and are often isolated from major combat units. As such they are frequent targets for enemy attacks and when this occurs equipment is usually damaged or destroyed causing systems at the site to become non-operational and vehicles unable to move.

In the game signal sites are divided into three catagories: (1) low risk, (2) medium risk, and (3) high risk. The low risk catagory contains corps main, alternate, and artillery and is designated as low risk because of the sites proximity to major headquarters. Medium risk sites include all others except radio relay sites which are high risk because of their isolation.

During the Setup Phase of the game a time is established for an attack on each site by sampling a uniform distribution associated with the risk catagory of the site. When sufficient play time has elapsed for the attack players receive a message that the attack has occurred.

Associated with each risk catagory is a probability p that a vehicle or piece of communications equipment has been damaged upon attack. Each vehicle and piece of communications equipment subject to failure is inspected and if operational caused to fail with probability p. The value of p associated with low risk sites is the smallest due both to the amount of equipment located there and the speed with which assistance can be expected. High risk sites, on the other hand, have the largest value of p because of their isolation.

The players are notified of any equipment failures due to the attack and these failures are handled identically as those described in sections a through e above.

2. Player Initiated Actions

Since the computer, playing the roles of nature and the enemy, is periodically changing the status of the communications network installed by the simulated battalion provision has been made to allow the players to react to these changes. By typing desired changes on the remote teletype the players are able to take corrective action similar to that required in actual combat. The player initiated actions, described briefly below, are discussed in more detail in the Program Construction Section.

Players are provided the option of issuing commands when either thirty minutes of play has elapsed since their last opportunity or after a computer introduced action has occurred - whichever happens first. At these times the players are allowed to introduce as many commands as they desire.

a. Remove Communications Equipment from System

The players are allowed to remove the three types of communications equipment discussed above from communications systems. They do this by specifying the type of equipment, the site number, the system number, and the type of system when necessary. Since it takes little time to disconnect an actual piece of communications equipment from a system the disconnect is accomplished immediately by the computer. If the removal of this piece of equipment makes the system inoperative the players are notified by a printed message. If the command cannot be accomplished, possibly because no system exists at the site with the specified system number or the equipment has already been disconnected, the players receive a message to that effect.

b. Install Communications Equipment on System

The same three types of communications equipment which can be removed from systems may also be installed on systems. The players accomplish this by specifying the equipment type, site number, system number, system type, and vehicle number for the installation. Since installation of communications equipment is not instantaneous the computer determines the time required for installation by taking a sample from a stored truncated normal installation time distribution. Upon receiving the installation command the players receive a reply that the installation has begun. After the installation time has elapsed the players receive another message that it has been completed. If the installation of this item is sufficient to make the system involved operational the status of the system is changed and the players are notified.

As in the removal case if the command is impossible to accomplish because of lack of equipment, no existing system, or equipment already connected the players receive a message informing them of the problem.

c. Remove System

The players may remove existing systems by supplying the computer with the system type, number, and sites involved. It is not necessary to remove the equipment from the system since this command also removes connected equipment. System removal is accomplished immediately upon command and the players are notified of its completion and of any communications equipment removed. Commands of this type which cannot be executed are again refused and the players notified of the reason.

d. Install Systems

Installation of systems is accomplished by providing the computer with the system type, number, and sites involved. Systems are installed without communications equipment and as such are non-operational. Players use the communications equipment installation command to inform the computer of the specific radios and multiplex equipment to be used. Installation is accomplished with no delay and the players are informed if the command cannot be executed due to an existing system of the same type and number between the sites involved.

e. Move Vehicles

Players may move vehicles and generators between communications sites by providing the computer with the vehicle type, location, and destination. A preliminary transit time, based on the distance between sites, is calculated by the computer upon receipt of the command. The actual transit time is computed by sampling a truncated normal distribution with the preliminary transit time used as the mean.

If the command can be executed the players receive a reply that transit has begun immediately after the command has been entered. Another message is printed when the vehicle arrives at its destination. If a vehicle failure occurs during transit the players are notified in the manner described in the vehicle failure section.

The move vehicle command is not implemented by the computer if the vehicle is not located at the site indicated, it is non-operational, if communications equipment in the vehicle is still connected to a system, or the destination site does not exist.

f. Install Site

The players install new sites by simply giving the grid coordinates of the new location and providing a site number. In a manner similar to the Setup Phase the computer determines if the site is supporting a tactical headquarters or is a radio relay site. This command is not accepted, and the players notified, if there already exists a site of the same number. Communications equipment and vehicles must be moved to the site by the vehicle movement command.

g. Information Commands

As the game progresses numerous changes are made in the deployment of, and communications provided by, the Corps Signal Battalion.

Even though it is recommended that the players maintain communications status charts on acetate covered boards to facilitate easy updating and reference it is possible for mistakes to be made.

In the event of a question concerning any or all of the sites the players may utilize information commands provided to print tables describing the current status of equipment and systems. Commands provide the option of printing at the teletype terminal that segment of the master table of equipment placement and systems involving a single site. This table provides information on all the vehicles located at the site, their operational status, the systems currently using the communications equipment in the vehicles, the status of the systems, and the deadlined equipment for the vehicles. If this information is desired on all sites it is automatically printed offline on a high speed printer. A table is also available listing the location and status of generators in the battalion.

D. EVALUATION OF PLAY

The game may be terminated at any time desired by issuing the game termination command. Although it would be desirable to have tables of play statistics such as system outage times, equipment deadlined times, and number and type of vehicle movements, the time available for formulating this thesis did not allow these to be included.

The primary value of the game is the insight into the problems and interrelationships present in a Corps Signal Battalion in the field. Players learn from their own mistakes and gain experience in the decisions required. Their knowledge of the capabilities and limitations of the available equipment is also reinforced.

Evaluation of the quality of student play and constructive suggestions are provided by the instructor who supervises the play of the group. By discussing key decisions and overall philosophy during and after the game the players acquire further insight into the techniques of deploying and operating the battalion.

III. INSTRUCTIONS FOR USE OF THE PROGRAM

A. INPUT/OUTPUT

Input data for the setup phase of the game may be entered either manually at the remote terminal or from data on punched cards. Input for the free play phase will always be entered at the remote terminal. All data entered into the game is in integer format and with the exception of the gameword and random number entries explained below an image of the input data is typed on the terminal immediately after its entry. The image provided by the computer allows the players to check if the input data was placed in the proper fields. Whenever input data is required at the terminal a message is printed indicating the information required and X's are placed on the terminal printout indicating the exact location of the fields in which to enter it. All input is numerical and if the field provided is larger than the number to be entered the input data must be right justified in the field.

B. GAME PLAY

1. Setup Phase

The setup phase of the game consists of game initialization, the entering of site locations, systems required, and equipment location, and the computer checks of this data.

a. Gameword

The first data request when starting the game is the message 'ENTER GAMEWORD'. The gameword is a two digit binary number which specifies the input/output options to be used. The players should enter the combination in Table I desired.

First Digit

0	Setup phase data to be entered at terminal
1	Setup phase data to be entered by punched cards

Second Digit

0	All output to be printed at terminal
1	All complete master tables and initial generator placement table to be printed offline

Gameword Values

Table I

b. Random Number

When the gameword has been entered a request 'ENTER ODD RANDOM NUMBER' is typed at the terminal. Although a field of seven digits is provided any odd number of seven or less digits is acceptable. The random number is used to start the assignment of those internal parameters determined by sampling distribution functions. Using the same random number on two different plays of the game will cause the initial equipment failure times, site attack times, and vehicle failures to be the same for each game.

c. Site, System, and Vehicle Placement Data

Site, system, and vehicle placement data is entered after the random number and the input is the same whether entered at the terminal or by punched cards. If the data is entered at the terminal instructions and fields are printed informing the players of the information desired. The advantage of using punched cards is in the time saved for input since cards may be punched prior to actual game play and read in at the time of play. If punched cards are used a copy of how the data would have appeared if entered at the terminal is automatically printed offline for easy reference.

The data requested is divided into three sections: (1) site placement, (2) system installation, and (3) vehicle placement. For site placement first the total number of sites is entered and then the grid coordinates of the individual sites. For systems, radio-relay are entered first followed by multichannel cable and high frequency. For each of these the total number of systems of a given type is entered first followed by the system number, from site, and to site. Vehicles are entered in the order AN/MRC-102, AN/MRC-103, AN/MCC-6, AN/GRC-26, and generators. For each type the number of sites at which vehicles are to be placed is first entered followed by individual site numbers with the number of vehicles to be placed at the site.

If data is entered at the terminal the players have the option of making changes or corrections to it immediately after each block is entered. They made changes or corrections after replying affirmatively to a query by the computer after the desired block is entered.

When all data has been entered the computer prints error messages at the terminal if enough equipment has not been located to provide the systems ordered installed. A complete master table and a table of generator placement is printed at the end of the setup phase.

2. Free Play Phase

The free play phase is entered automatically after the setup phase. Players are given the option of entering commands after each thirty minutes of simulation time or a computer introduced action - whichever occurs first. Computer introduced actions are discussed in the Description of the Game section. The simulation day and time is printed each time the players are allowed to enter a command. If no action is desired the command '000' allows the game to proceed. If additional information is required to execute a command the players are asked by the computer to provide it after the initial command submission. Player commands available are listed in Table II. A description of the commands is also given in the Description of the Game section.

C. GAME TERMINATION

Termination of the game is accomplished by a player command of '999'.

Command	Description
100	Complete master table is printed
1XX	Master table segment for site XX is printed
150	Complete generator placement table is printed
201	Remove AN/GRC-50 from system
202	Remove AN/TCC-7 from system
203	Remove AN/GRC-26 from system
301	Install AN/GRC-50 on system
302	Install AN/TCC-7 on system
303	Install AN/GRC-26 on system
401	Remove cable system
402	Remove radio-relay system
403	Remove high frequency system
501	Install cable system
502	Install radio-relay system
503	Install high frequency system
601	Move AN/MRC-103
602	Move AN/MCC-6
603	Move AN/MRC-102
604	Move AN/GRC-26
605	Move generator
701	Install site

Player Commands Available in Game

TABLE II

IV. PROGRAM CONSTRUCTION

A. GENERAL

The computer assisted game presented in this thesis employs the next-event simulation construction technique discussed in detail in reference (1). Although the game was written in FORTRAN IV many of the more powerful commands available were not used in order to simplify the task of transferring the program to other computers having only a modified FORTRAN II capability. The program was constructed using an IBM 360-67 computer with a time sharing system.

Little effort was made to reduce the computation times involved in the program since this occupies only a small fraction of the total play time. Most of the play time is consumed by the players analyzing the tactical environment and choosing their course of action. Complex constructions were avoided and some redundancy was allowed in order to make the program logic clear enough to allow future additions and changes by users of the game. Numerous comment cards were also inserted for this purpose.

B. OVERVIEW OF CONSTRUCTION

Four types of simulation units are used in the program: (1) communications vehicles, (2) communications equipment, (3) communications systems, and (4) communications sites. The simulation units are integer variables, each representing a single piece of equipment, a system, or a site. They are made up of packed numbers which completely describe the state of all simulated equipment and systems. Table III provides a summary of the simulation units and array names.

Description	State Variable	Designation	Array Name
Radio Site	Unit supporting XX XXXXXX location	N/A	LOCSIT
Radio and Cable Systems	op/non-op flag to X XX XX X from system number	Radio Relay	IRRSYS
		High Freq.	IHFSYS
		Cable	ICBSYS
Communications Vehicles	transit flag op/non-op flag XXXX XX X X km until site next at failure	AN/MRC-102	IM102
		AN/MRC-103	IM103
		AN/MCC-6	IMCC6
		AN/GRC-26	IV26
		Generator	IGEN
Radio and Multiplex Equipment	op/non-op veh flag type X XX XXX X X veh sys # type sys # to site #	AN/GRC-26	IGRC26
		AN/GRC-50	IGRC50
		AN/TCC-7	ITCC7

Vehicle Type

1 - AN/MRC-102
2 - AN/MRC-103
3 - AN/MCC-6
4 - AN/GRC-26

System Type

1 - Cable
2 - Radio Relay
3 - High Freq.

Simulation Units

TABLE III

IEVCAL (I) $\underbrace{XX}_{\text{type}}\,\overbrace{X}^{\text{unit type}}\,\underbrace{XXX}_{\text{unit \#}}$

JEVCAL (I) $\underbrace{XXXXXX}_{\text{time in minutes}}$

Type

1 - Equipment failure
2 - Equipment repair
3 - Equipment installation complete
4 - Vehicle movement complete
5 - Vehicle breakdown
6 - Vehicle repair
7 - Site attack

Unit Type

1 - AN/GRC-50
2 - AN/TCC-7
3 - AN/GRC-26
4 - Generator
1,6 - AN/MRC-103
2,7 - AN/MCC-6
3,8 - AN/MRC-102
4,9 - AN/GRC-26
5,10 - Generator

Events in Future
Events Table

TABLE IV

Seven types of simulation events are created internally by the computer and stored in the future events table. Simulation events are used to implement computer introduced events which may or may not be a result of past player introduced actions. Table IV provides a summary of internally created events.

C. SUBROUTINE CONSTRUCTION

The following sections provide a short description of the main program and twenty-nine subroutines used in the program with gross flow charts included for major subroutines. A complete listing of the program is included in a later section of the thesis.

1. Main Program

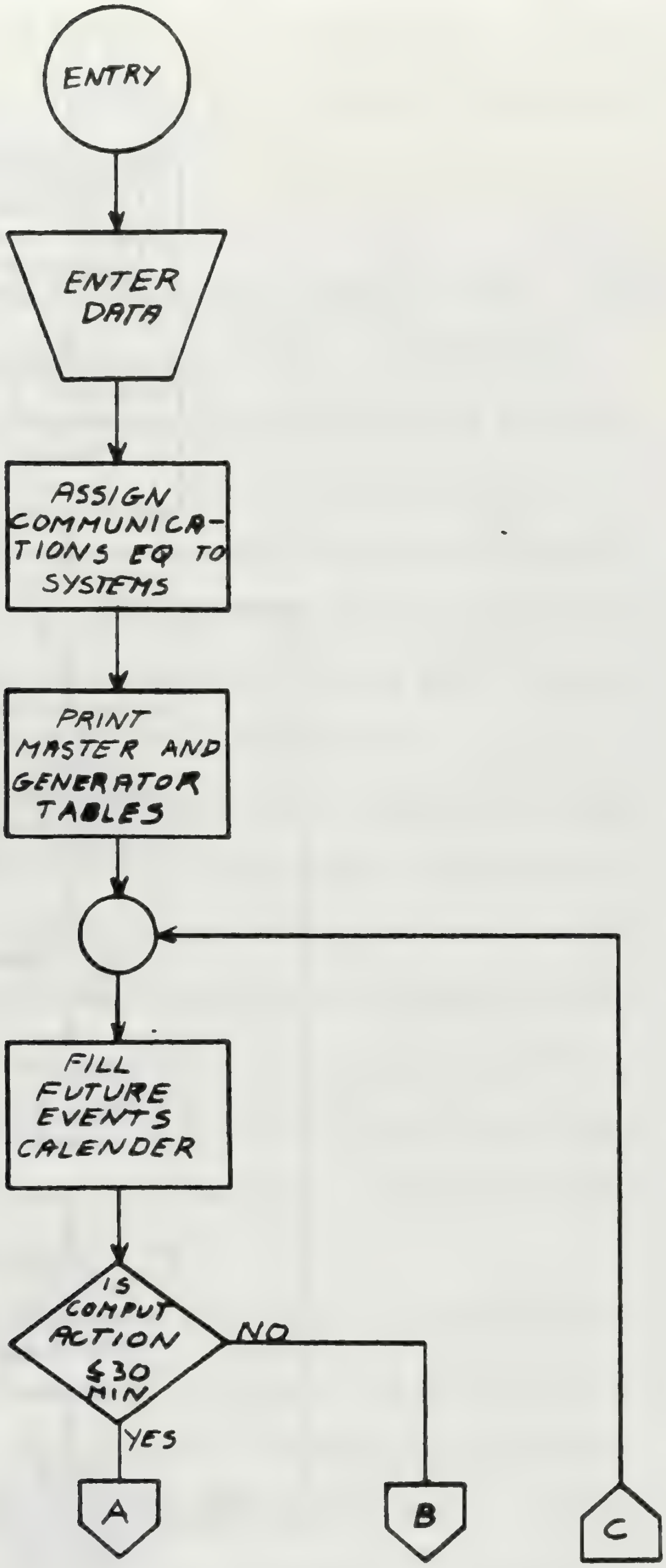
The main program (Figure 1) serves two primary functions. During the setup phase of the game it is a calling routine which causes data to be read, equipment assigned, and initial tables to be printed. During the free play phase it determines when computer introduced events are to be used and accepts and processes player introduced decisions.

2. Subroutine INPT

Subroutine INPT accepts data for the setup phase of the game either from cards or directly from the terminal. This subroutine also calls the initial failure time program discussed below (INFAIL) to determine the time of first failure for communications equipment and vehicles.

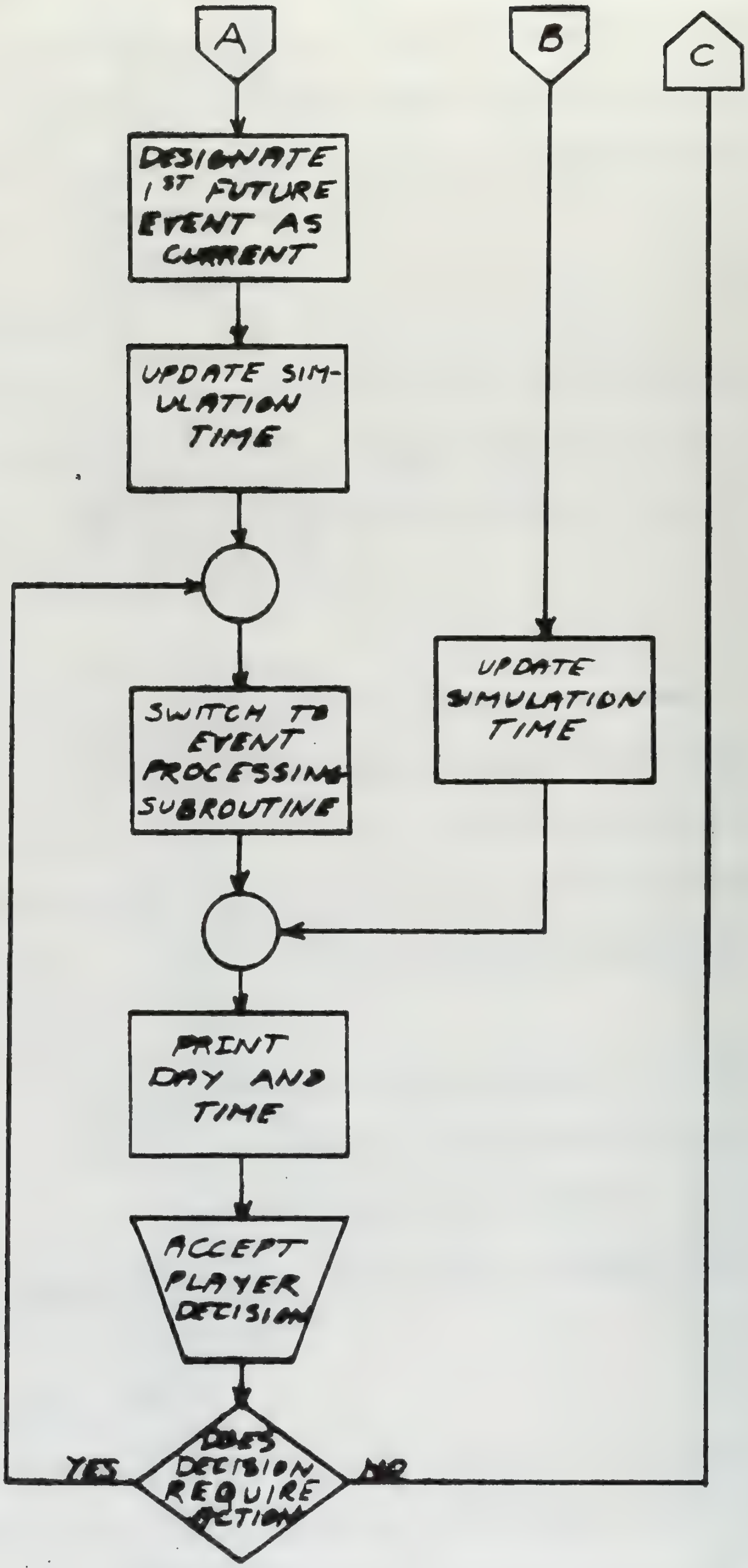
3. Subroutine ASSIGN

Subroutine ASSIGN first assigns radios organic to the battalion to communications vehicles for internal bookkeeping purposes and then assigns the battalion communications equipment which was placed by


ENTRY
ENTER DATA
ASSIGN COMMUNICATIONS EQ TO SYSTEMS
PRINT MASTER AND GENERATOR TABLES
FILL FUTURE EVENTS CALENDER
IS COMPUT ACTION ≤30 MIN
NO
YES
A
B
C

MAIN PROGRAM

Figure 1


A
B
C
DESIGNATE 1ST FUTURE EVENT AS CURRENT
UPDATE SIMULATION TIME
SWITCH TO EVENT PROCESSING SUBROUTINE
UPDATE SIMULATION TIME
PRINT DAY AND TIME
ACCEPT PLAYER DECISION
DOES DECISION REQUIRE ACTION
YES
NO

MAIN PROGRAM (Cont.)

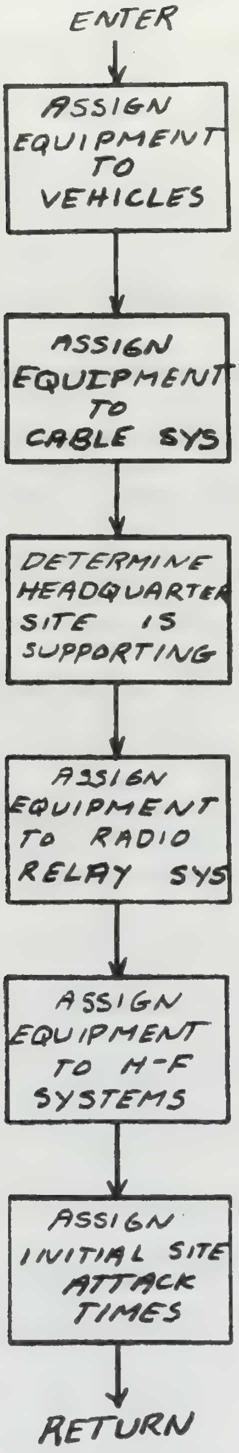
the players to the systems ordered installed. The designation of the headquarters which the sites are supporting is determined and the initial site attack times are computed. Figures 2 to 6 illustrate the construction of this subroutine.

4. Subroutine INFAIL

Subroutine INFAIL (Figure 7) is used to assign initial failure times to both communications equipment and vehicles. The need for a separate subroutine for this task, rather than simply taking a sample from the appropriate truncated normal time to failure distribution, is the assumption that all communications equipment and vehicles have been operating for an undefined period of time and are not newly repaired. As a result of this some equipment may be close to failing while others may have been operating after repair only a very short time.

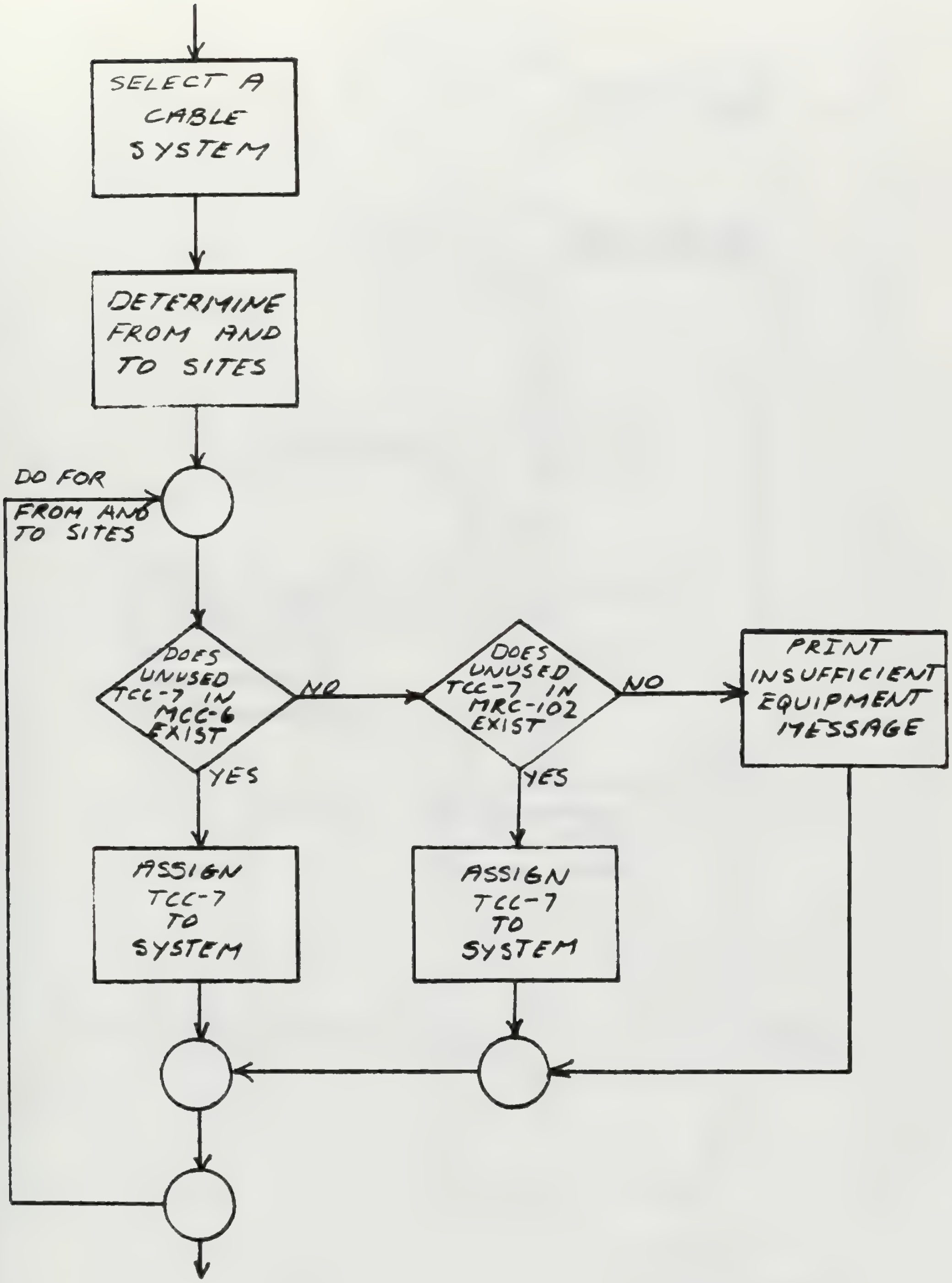
The goal of this subroutine is to provide a sample from the equilibrium distribution of the truncated normal failure distribution for an item (see Reference 8 for a discussion of renewal theory mathematics). Although a mathematical technique exists for determining the exact form of the equilibrium distribution by integrating over the tail of the failure distribution function the truncated normal distribution function, which cannot be expressed in closed form, does not produce a closed form result upon integration.

The method used in INFAIL to approximate a sample from the equilibrium distribution is to choose an arbitrary time t to use as a comparison time. Samples are taken from the truncated normal failure distribution of an item and added together until their sum is equal to or greater than t. The difference between the sum and t is an approximate sample from the equilibrium distribution.


ENTER
ASSIGN EQUIPMENT TO VEHICLES
ASSIGN EQUIPMENT TO CABLE SYS
DETERMINE HEADQUARTER SITE IS SUPPORTING
ASSIGN EQUIPMENT TO RADIO RELAY SYS
ASSIGN EQUIPMENT TO H-F SYSTEMS
ASSIGN INITIAL SITE ATTACK TIMES
RETURN

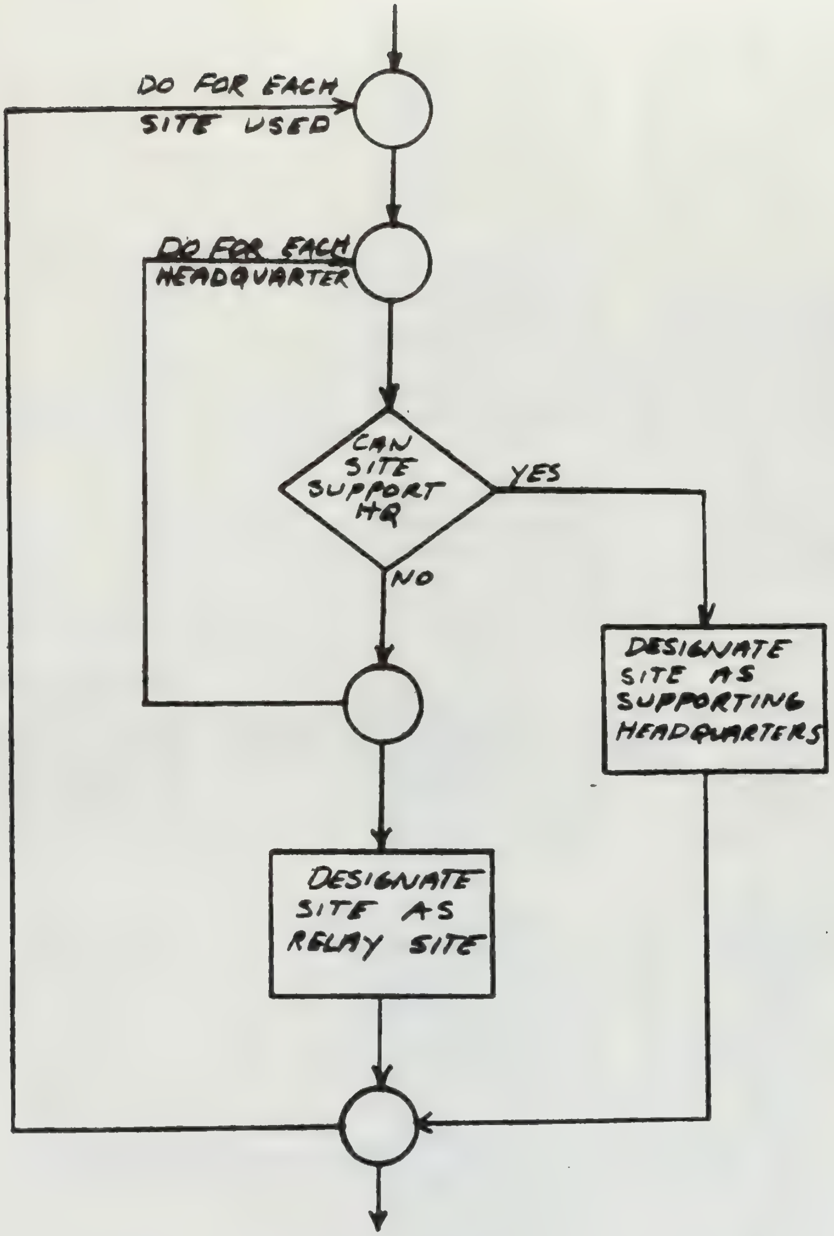
Subroutine ASSIGN

Figure 2


SELECT A CABLE SYSTEM
DETERMINE FROM AND TO SITES
DO FOR FROM AND TO SITES
DOES UNUSED TCC-7 IN MCC-6 EXIST
NO
YES
DOES UNUSED TCC-7 IN MRC-102 EXIST
NO
YES
PRINT INSUFFICIENT EQUIPMENT MESSAGE
ASSIGN TCC-7 TO SYSTEM
ASSIGN TCC-7 TO SYSTEM

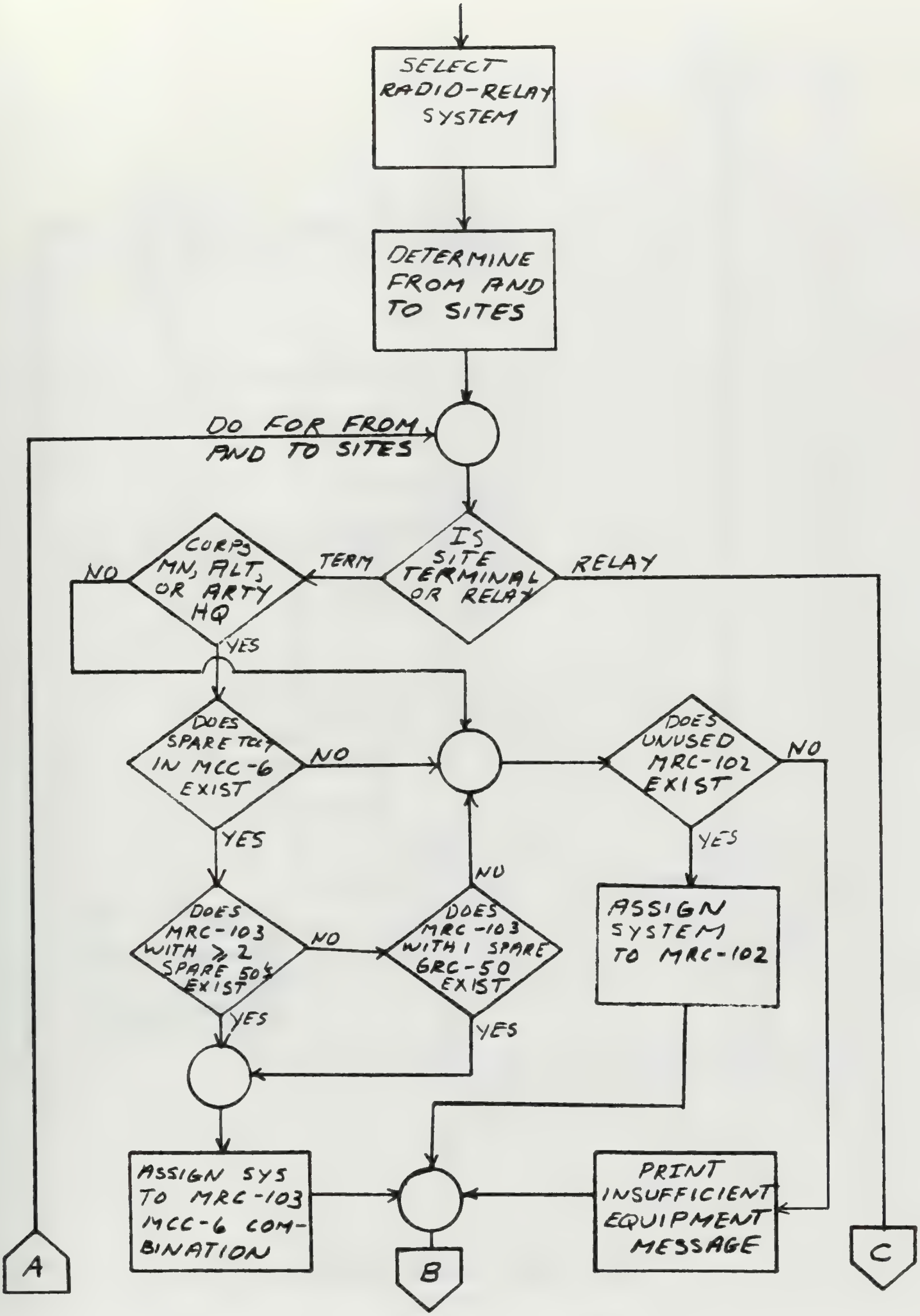
Cable System Assignment

Figure 3


DO FOR EACH SITE USED
DO FOR EACH HEADQUARTER
CAN SITE SUPPORT HQ
YES
NO
DESIGNATE SITE AS SUPPORTING HEADQUARTERS
DESIGNATE SITE AS RELAY SITE

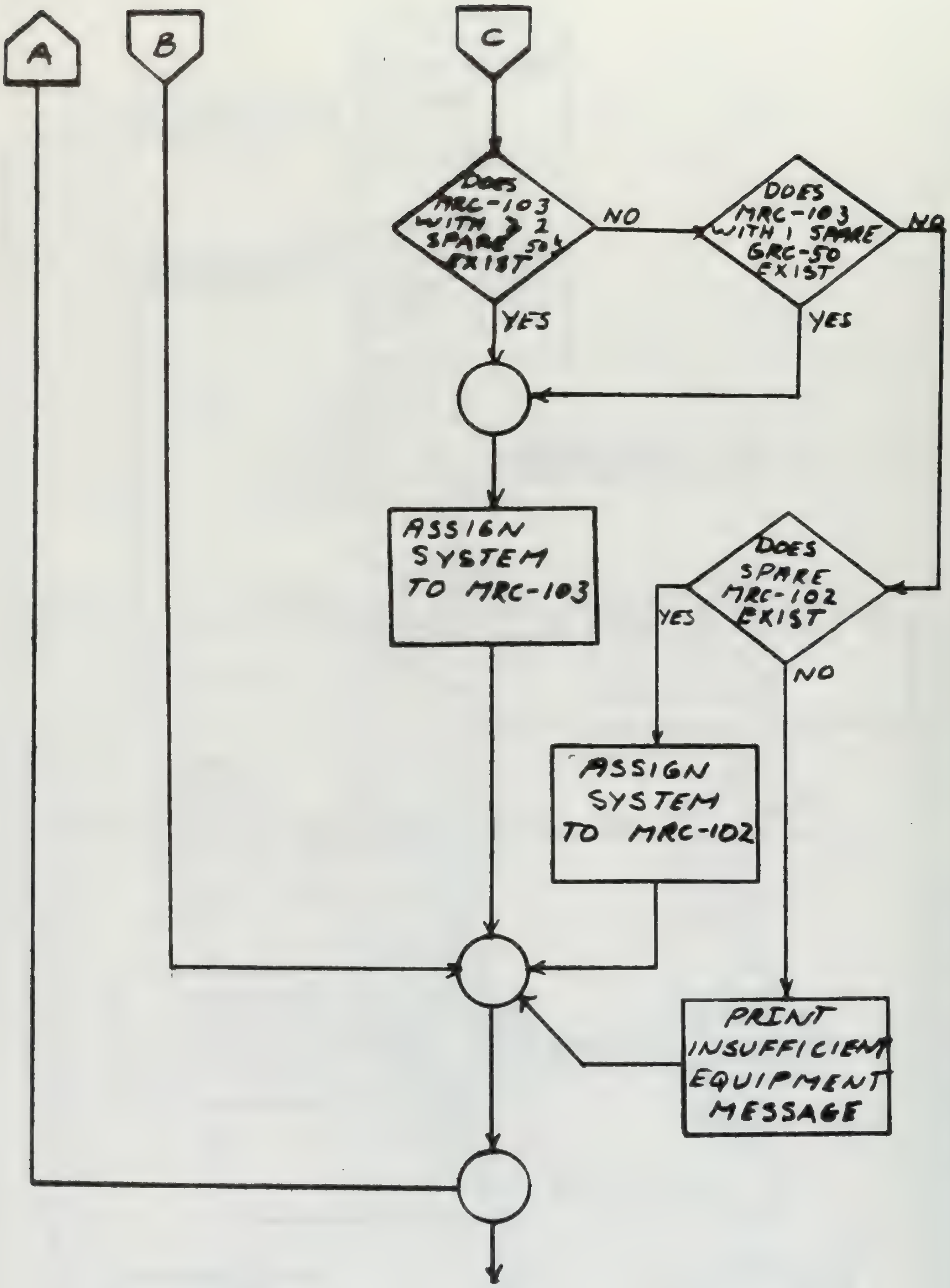
Headquarters Assignment

Figure 4

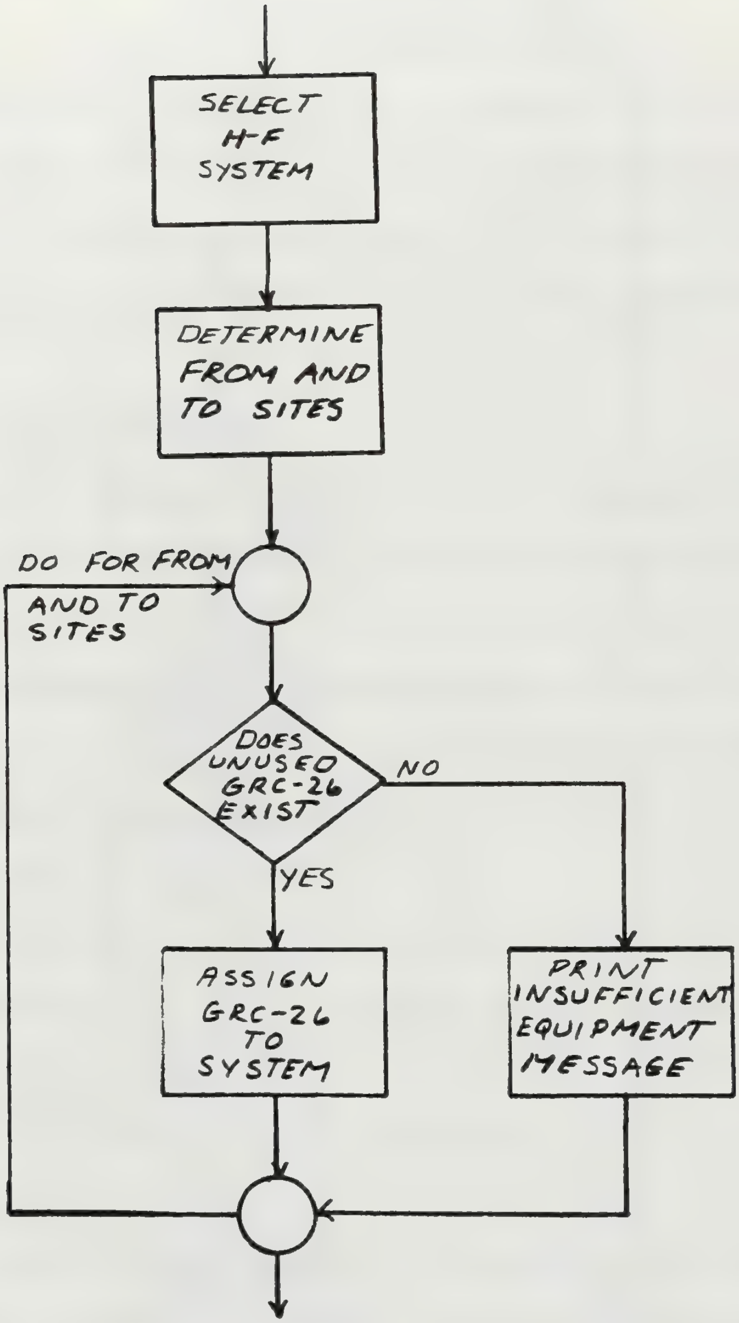

SELECT RADIO-RELAY SYSTEM
DETERMINE FROM AND TO SITES
DO FOR FROM AND TO SITES
IS SITE TERMINAL OR RELAY
TERM
RELAY
CORPS MN, ALT, OR ARTY HQ
NO
YES
DOES SPARE TCCY IN MCC-6 EXIST
NO
YES
DOES UNUSED MRC-102 EXIST
NO
YES
ASSIGN SYSTEM TO MRC-102
DOES MRC-103 WITH ≥ 2 SPARE 50's EXIST
NO
YES
DOES MRC-103 WITH 1 SPARE GRC-50 EXIST
NO
YES
ASSIGN SYS TO MRC-103 MCC-6 COMBINATION
PRINT INSUFFICIENT EQUIPMENT MESSAGE
A
B
C

Radio Relay System Assignment

Figure 5

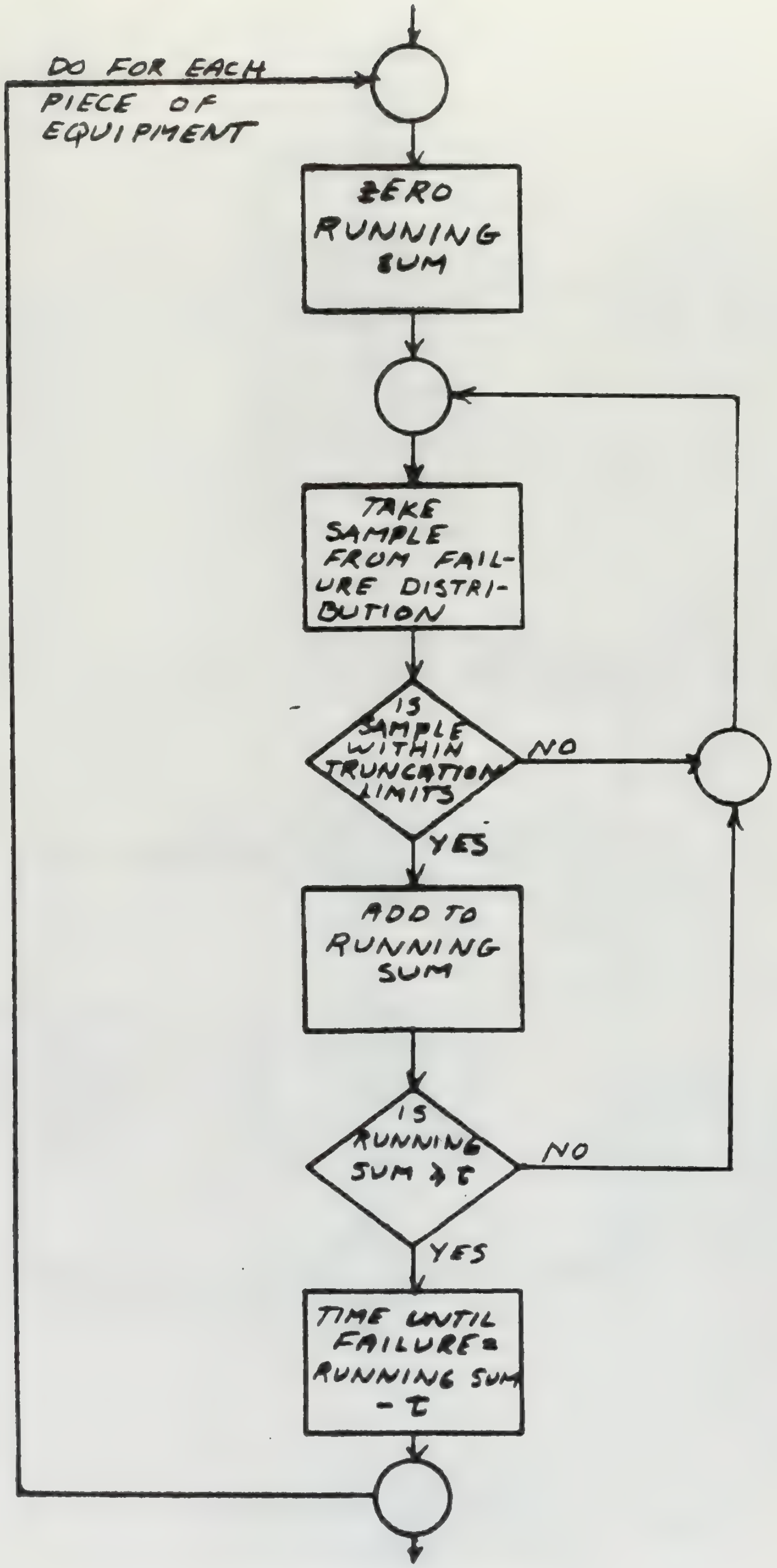

A
B
C
DOES MRC-103 WITH ≥ 2 SPARE 50's EXIST
NO
YES
DOES MRC-103 WITH 1 SPARE GRC-50 EXIST
NO
YES
ASSIGN SYSTEM TO MRC-103
DOES SPARE MRC-102 EXIST
YES
NO
ASSIGN SYSTEM TO MRC-102
PRINT INSUFFICIENT EQUIPMENT MESSAGE

Radio Relay System Assignment (Cont.)



H-F System Assignment

Figure 6


DO FOR EACH PIECE OF EQUIPMENT
ZERO RUNNING SUM
TAKE SAMPLE FROM FAILURE DISTRIBUTION
IS SAMPLE WITHIN TRUNCATION LIMITS
NO
YES
ADD TO RUNNING SUM
IS RUNNING SUM ≥ τ
NO
YES
TIME UNTIL FAILURE = RUNNING SUM - τ

Subroutine INFAIL

Figure 7

The accuracy of the approximation depends on the parameters of the failure distribution, truncation limits, and t. As t gets large without bound the resulting distribution approaches the true equilibrium distribution. Unfortunately as t is made larger more samples must be taken from the failure distribution resulting in larger computational times. The values of t used in the program were determined by a separate analysis which compared the changes in the approximated equilibrium distribution as t was varied.

5. Subroutines TABLE and TABLE1

Subroutine TABLE is used to examine the simulation units in order to produce a table of the status and location of communications vehicles by site. When the complete table is printed it orders the sites numerically and gives supported headquarters and grid coordinates of the site. Subroutine TABLE1 is used to print individual lines of the table after they are generated by subroutine TABLE.

6. Subroutine SYSOP

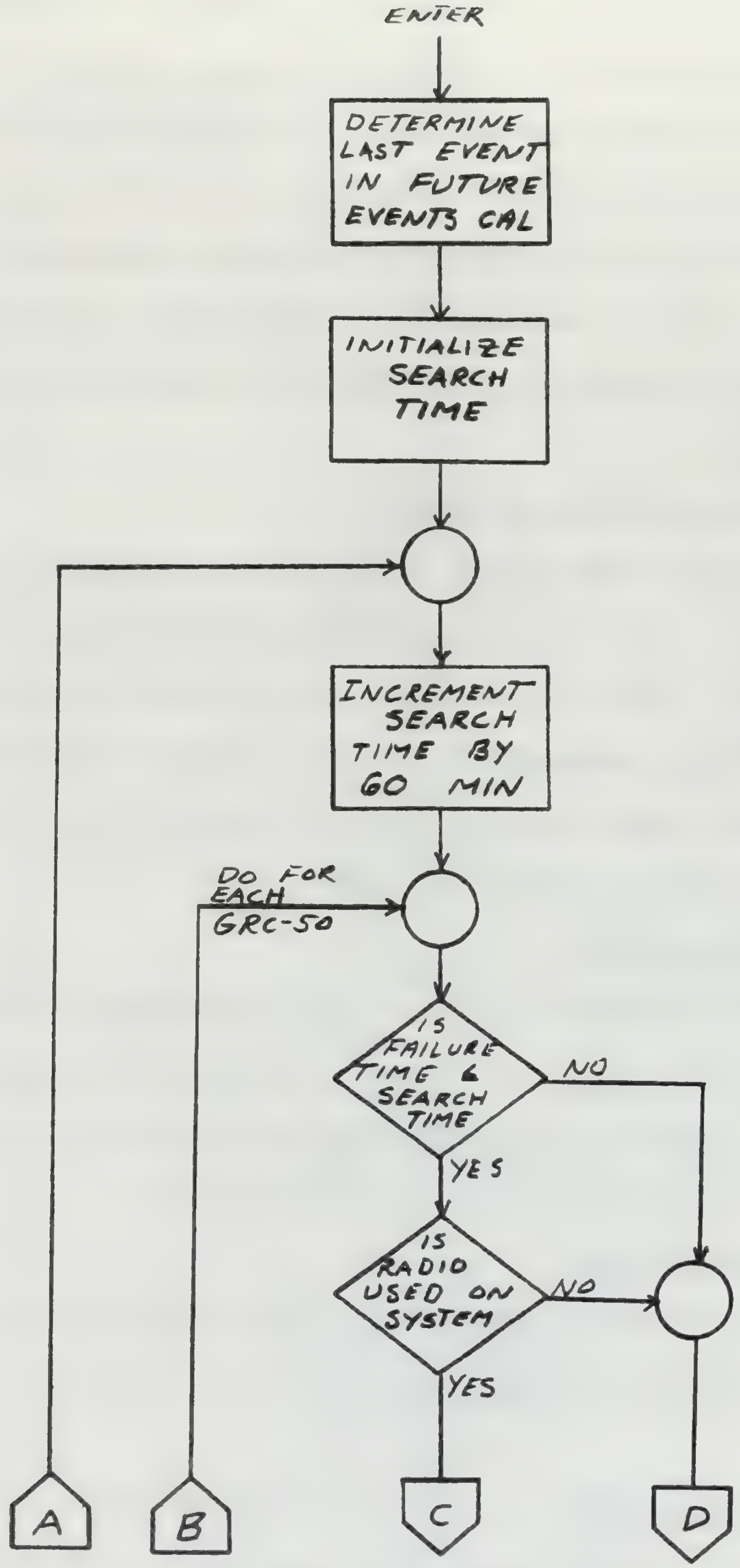
Subroutine SYSOP is used to locate and determine the operational status of the system unit in the appropriate system array when provided with the terminal site numbers and system number. If the system does not exist an indicator to that effect is returned.

7. Subroutine GENTAB

Subroutine GENTAB produces a table of generators by site number. The number operational, deadlined, and total number are given for each site.

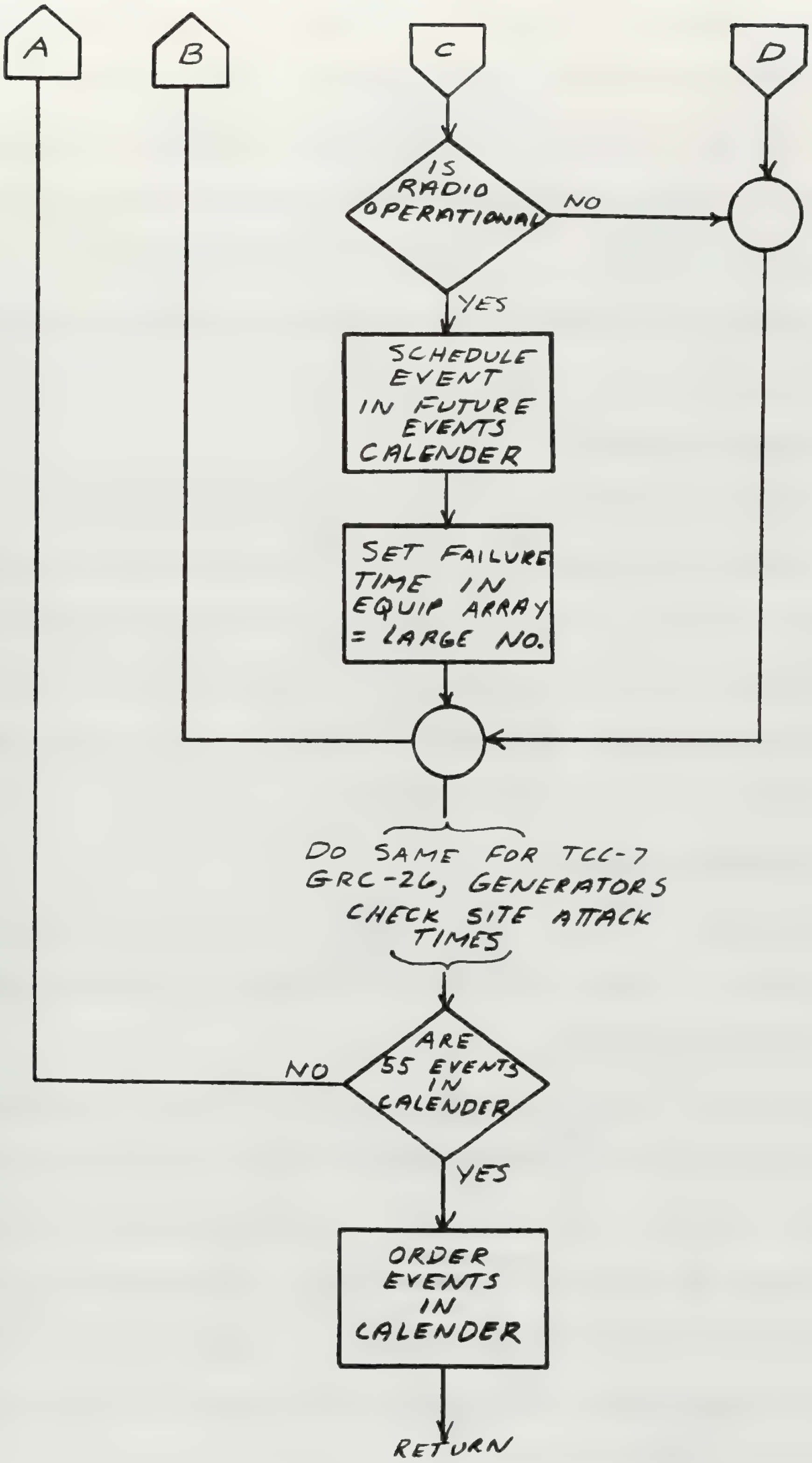
8. Subroutine SEARCH

Subroutine SEARCH (Figure 8) is used to place events in the future events calander by sequentially checking each equipment simulation


ENTER
DETERMINE LAST EVENT IN FUTURE EVENTS CAL
INITIALIZE SEARCH TIME
INCREMENT SEARCH TIME BY 60 MIN
DO FOR EACH GRC-50
IS FAILURE TIME ≤ SEARCH TIME
NO
YES
IS RADIO USED ON SYSTEM
NO
YES
A
B
C
D

Subroutine SEARCH

Figure 8


A
B
C
D
IS RADIO OPERATIONAL
NO
YES
SCHEDULE EVENT IN FUTURE EVENTS CALENDER
SET FAILURE TIME IN EQUIP ARRAY = LARGE NO.
DO SAME FOR TCC-7 GRC-26, GENERATORS CHECK SITE ATTACK TIMES
ARE 55 EVENTS IN CALENDER
NO
YES
ORDER EVENTS IN CALENDER
RETURN

Subroutine Search (Cont.)

unit subject to failure and each site placing those with the earliest occurrence times in the future events calander. Only equipment units which are operational and connected to a system are considered. The search for future events is stopped when fifty-five are present in the calander. This leaves enough room in the calander for including events caused by player decisions but provides enough to insure that the time of events used is sequential.

9. Subroutine UPDATE

Subroutine UPDATE is used to correct the time until failure of equipment subject to failure and in use but not included as events in the future events calander. After the simulation time is incremented UPDATE searches equipment arrays and subtracts the increment from the time until failure for the equipment. Site attack times not in the future events calander also have the increment subtracted.

10. Subroutine SWITCH

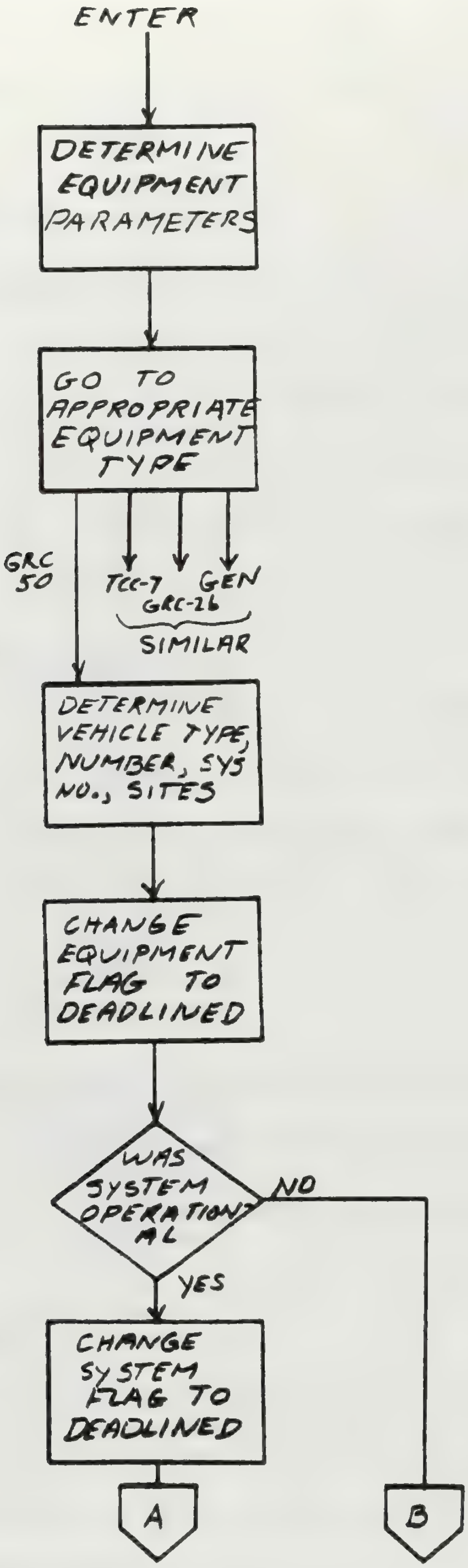
Subroutine SWITCH is used to call the subroutines necessary for processing either a player decision or an internally generated event.

11. Subroutine EQFAIL

Subroutine EQFAIL (Figure 9) is used to cause communications equipment to fail when an equipment failure event is designated as the current event. It also causes equipment failure when site attacks result in damaged equipment. If the equipment is connected to an operational system the system is caused to fail. A repair time is calculated and a repair event using it is scheduled. An estimate of repair time is printed for player information.

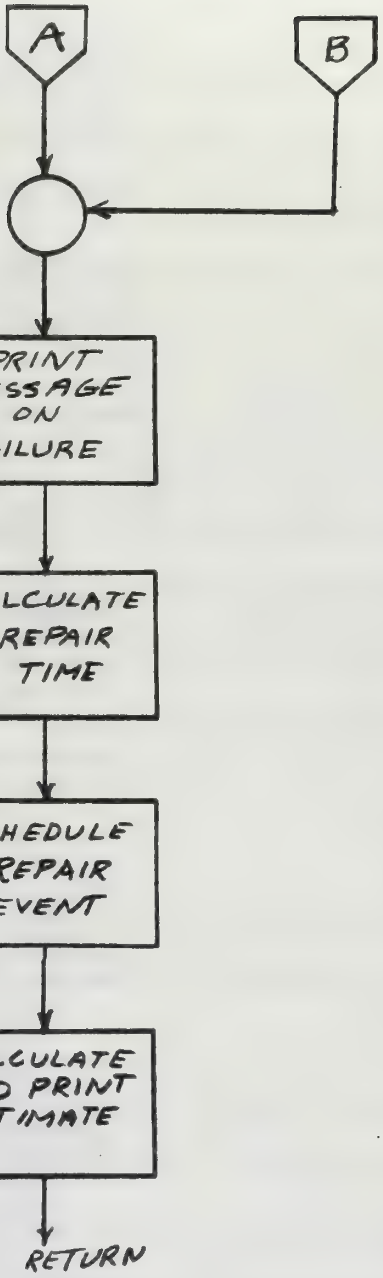
12. Subroutine EQREP

This subroutine is used to repair communication equipment after


ENTER
DETERMINE EQUIPMENT PARAMETERS
GO TO APPROPRIATE EQUIPMENT TYPE
GRC 50
TCC-7
GRC-26
GEN
SIMILAR
DETERMINE VEHICLE TYPE, NUMBER, SYS NO., SITES
CHANGE EQUIPMENT FLAG TO DEADLINED
WAS SYSTEM OPERATIONAL
NO
YES
CHANGE SYSTEM FLAG TO DEADLINED
A
B

Subroutine EQFAIL

Figure 9



Subroutine EQFAIL (Cont.)

a repair event becomes the current event. Although only the AN/GRC-50 radio is illustrated in Figure 10 the repair routine for the AN/TCC-7, AN/GRC-26, and generators is similar.

13. Subroutines OP50, OP7, and OP26

These subroutines are used in conjunction with subroutine EQREP. OP50 determines if the repaired AN/GRC-50 radio will enable the system to which it is connected to resume operation. This will occur only if operational equipment is currently connected wherever else required on the system. OP7 performs a similar function for AN/TCC-7 multiplex units and OP26 for AN/GRC-26 radios.

14. Subroutine VEHBKD

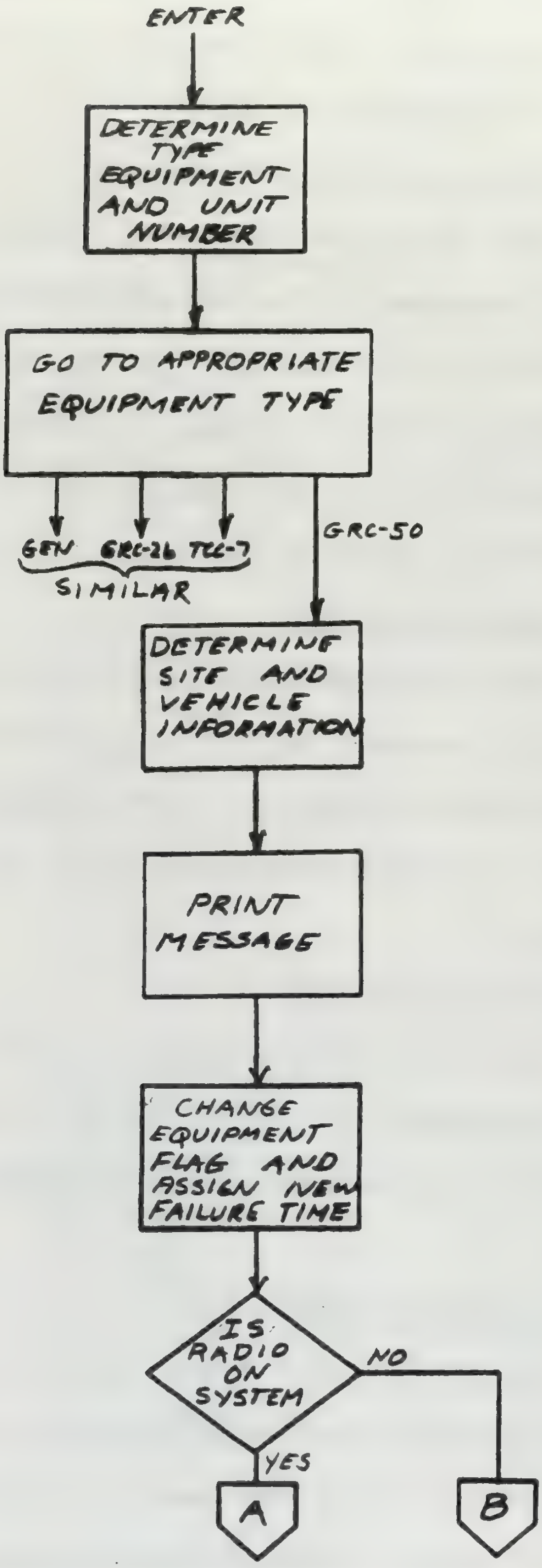
Subroutine VEHBKD (Figure 11) causes the communications vehicles and generators simulated in the program to break down during transit or site attack when the appropriate event becomes the current event. A repair event is scheduled and an estimate of repair time is printed for the players.

15. Subroutine VEHREP

Subroutine VEHREP (Figure 12) repairs vehicles when a repair event is encountered. If the vehicle was in transit to a site when it broke down the remainder of the trip is started and an arrival event is scheduled.

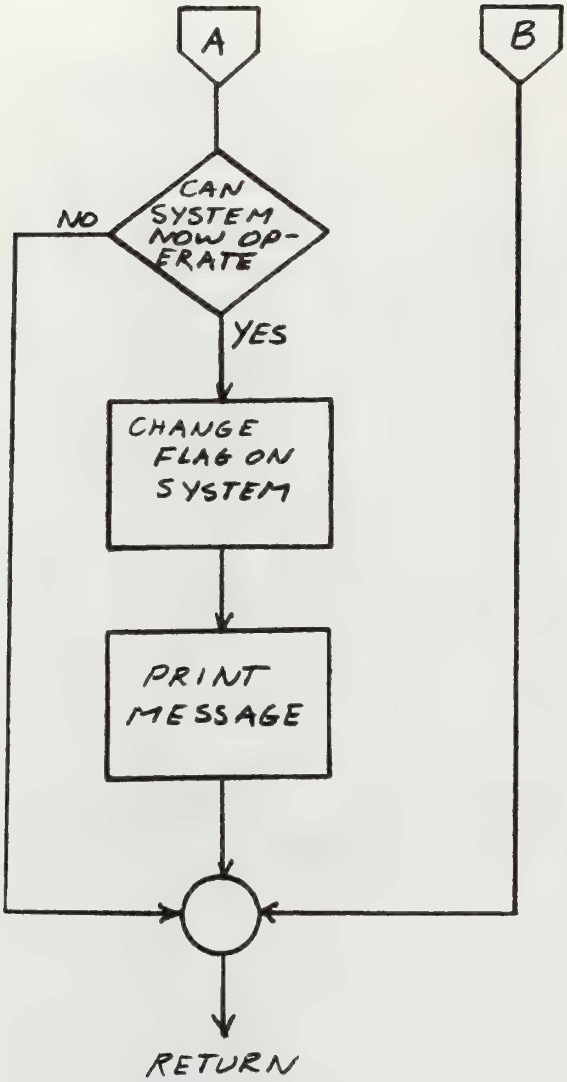
16. Subroutine SITACK

Subroutine SITACK (Figure 13) causes a specific site to be attacked and probabilistically determines which vehicles and equipment are damaged based on a probability assigned for the type of site. If a vehicle is damaged subroutine VEHBKD is called to process it while subroutine EQFAIL is called for equipment damage. The figure illustrates the process

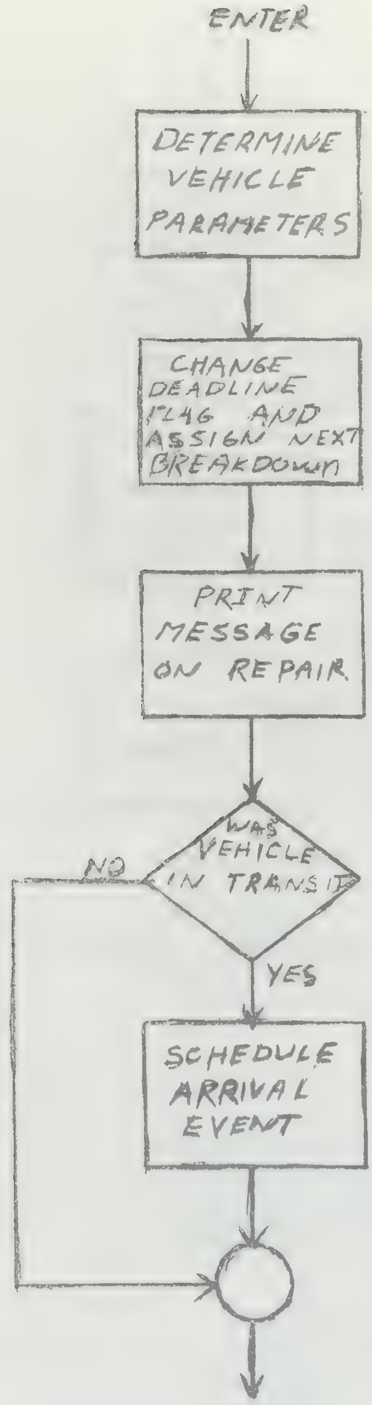

ENTER
DETERMINE TYPE EQUIPMENT AND UNIT NUMBER
GO TO APPROPRIATE EQUIPMENT TYPE
GEN
GRC-26
TCC-7
SIMILAR
GRC-50
DETERMINE SITE AND VEHICLE INFORMATION
PRINT MESSAGE
CHANGE EQUIPMENT FLAG AND ASSIGN NEW FAILURE TIME
IS RADIO ON SYSTEM
NO
YES
A
B

Subroutine EQREP

Figure 10

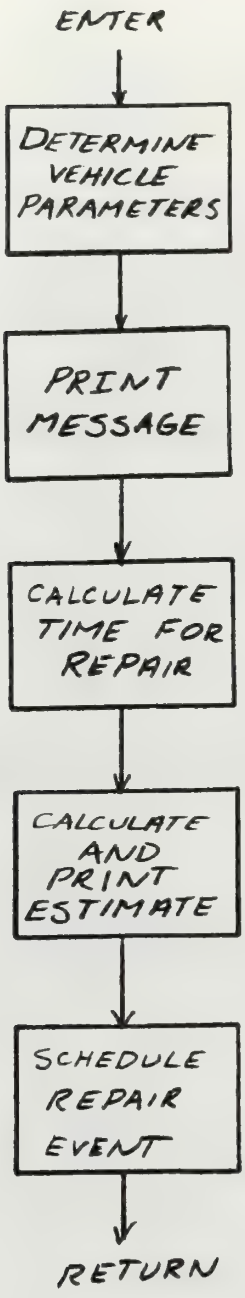


Subroutine EQREP (Cont.)



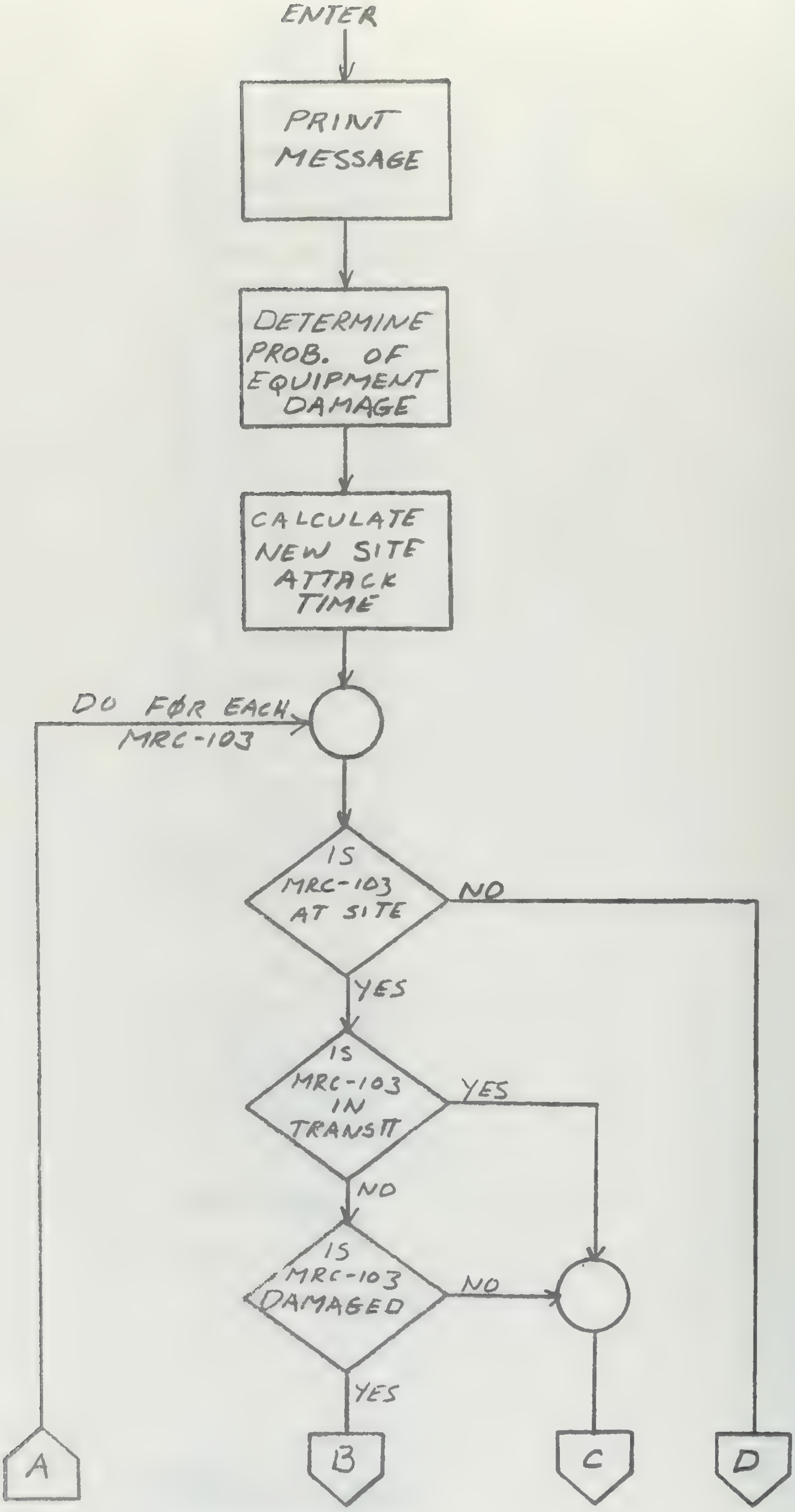
Subroutine VEHBKD

Figure 11


ENTER
DETERMINE VEHICLE PARAMETERS
PRINT MESSAGE
CALCULATE TIME FOR REPAIR
CALCULATE AND PRINT ESTIMATE
SCHEDULE REPAIR EVENT
RETURN

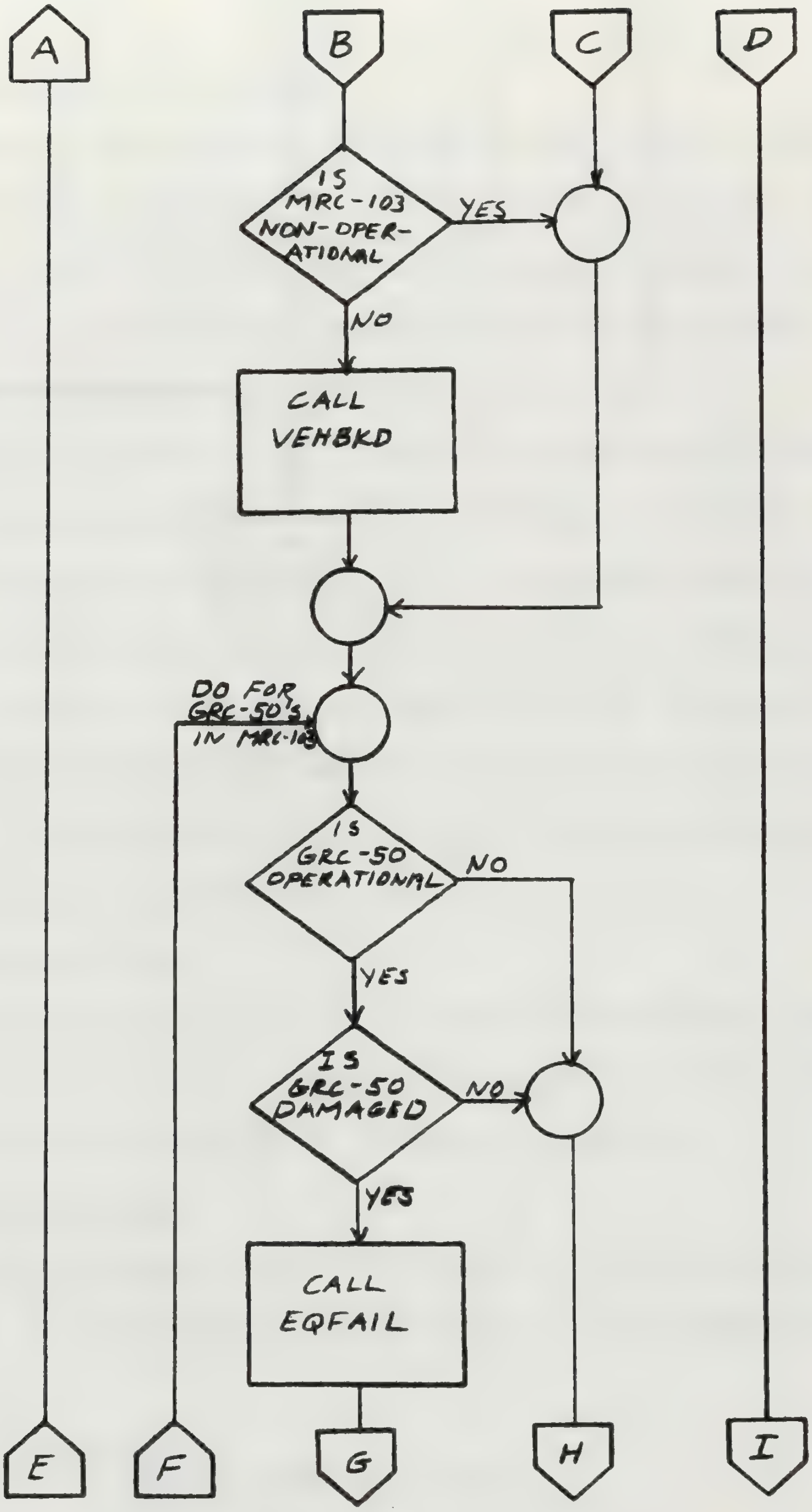
Subroutine VEHREP

Figure 12

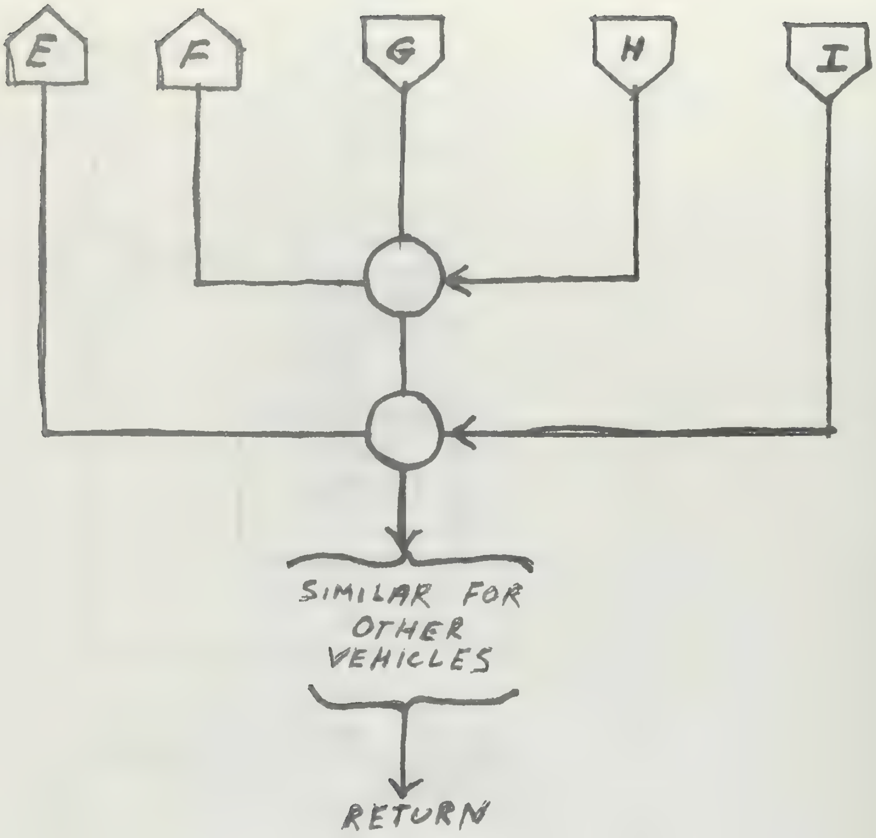


Subroutine SITACK

Figure 13



Subroutine SITACK (Cont.)



Subroutine SITACK (Cont.)

for AN/MRC-103 vehicles only although others are handled in a similar manner.

17. Subroutines EQREM and EQINST

Subroutine EQREM (Figure 14) is called when a player request for equipment removal is received. Subroutine EQINST (Figure 15), on the other hand, is used for connecting communications equipment on systems. For both of these subroutines only AN/GRC-50 radios are illustrated.

18. Subroutine CKEVNT

Subroutine CKEVNT is used to search the future events calander, when a radio or multiplex is repaired, for installation completion events on equipment in use on the same system. This is necessary since the parameters in the simulation unit for a piece of equipment are changed to reflect usage as soon as installation is begun even though the system cannot operate until the installation is complete. If an installation completion event on the same system is found the system cannot become operational with the equipment just repaired.

19. Subroutine SYSREM

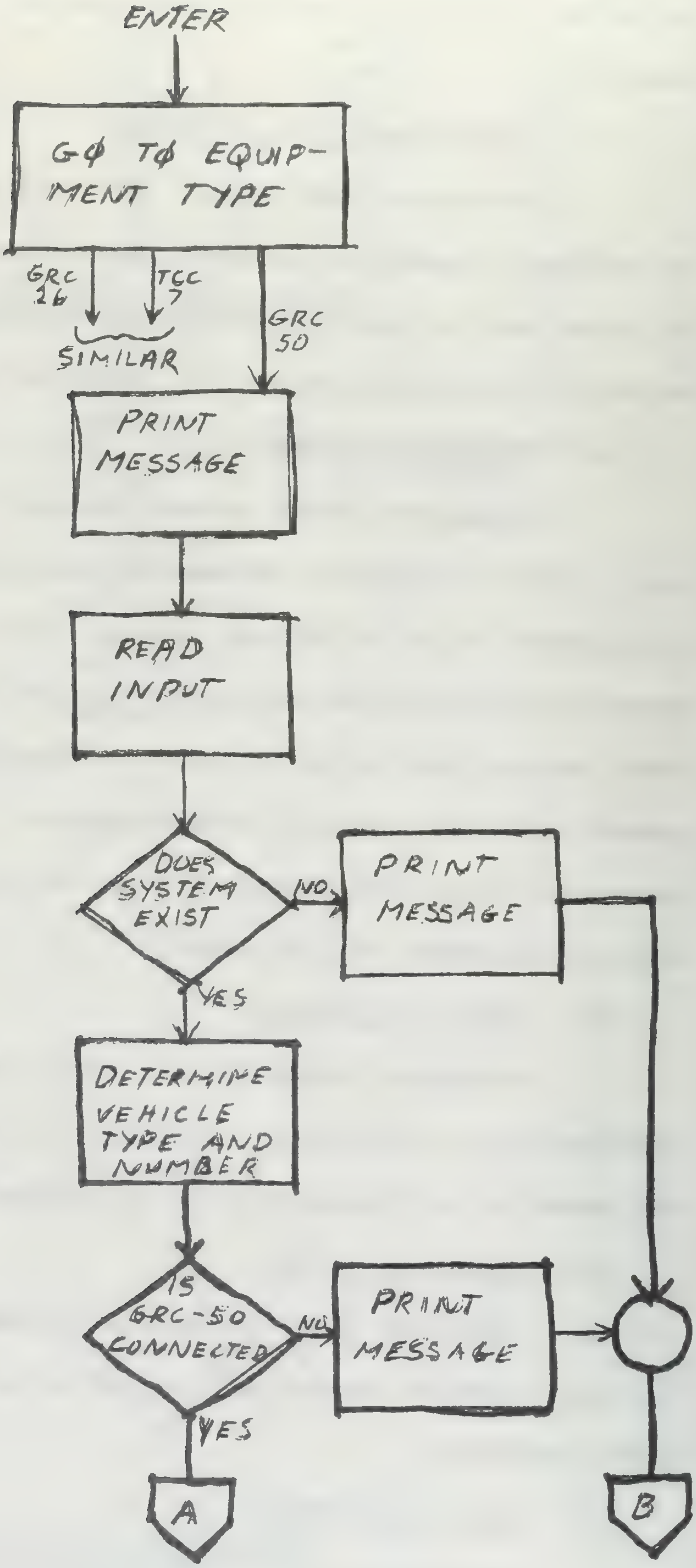
Subroutine SYSREM (Figure 16) is used to delete systems when this decision is entered by the players. If equipment is connected to the system it is disconnected and the players are notified.

20. Subroutine SYINST

Subroutine SYINST (Figure 17) is used for establishing any of the three types of communications systems on entry of the appropriate player decision.

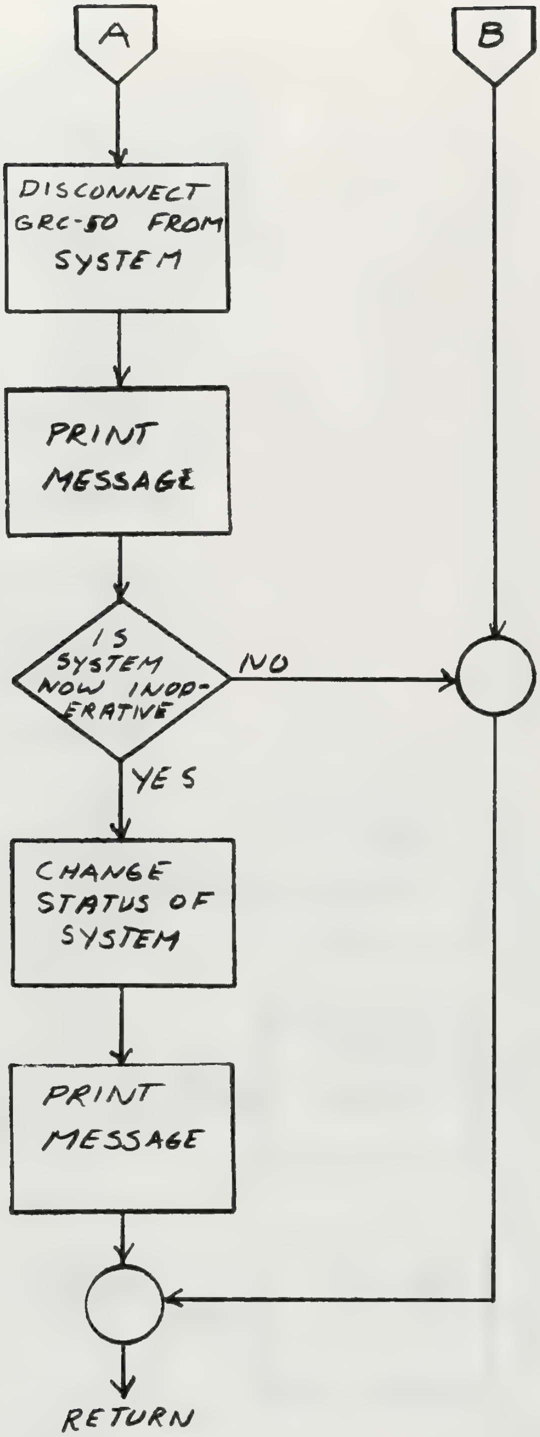
21. Subroutine VEHMOV

Subroutine VEHMOV (Figure 18) serves two functions. First it begins vehicle movement when the decision is received from the players.

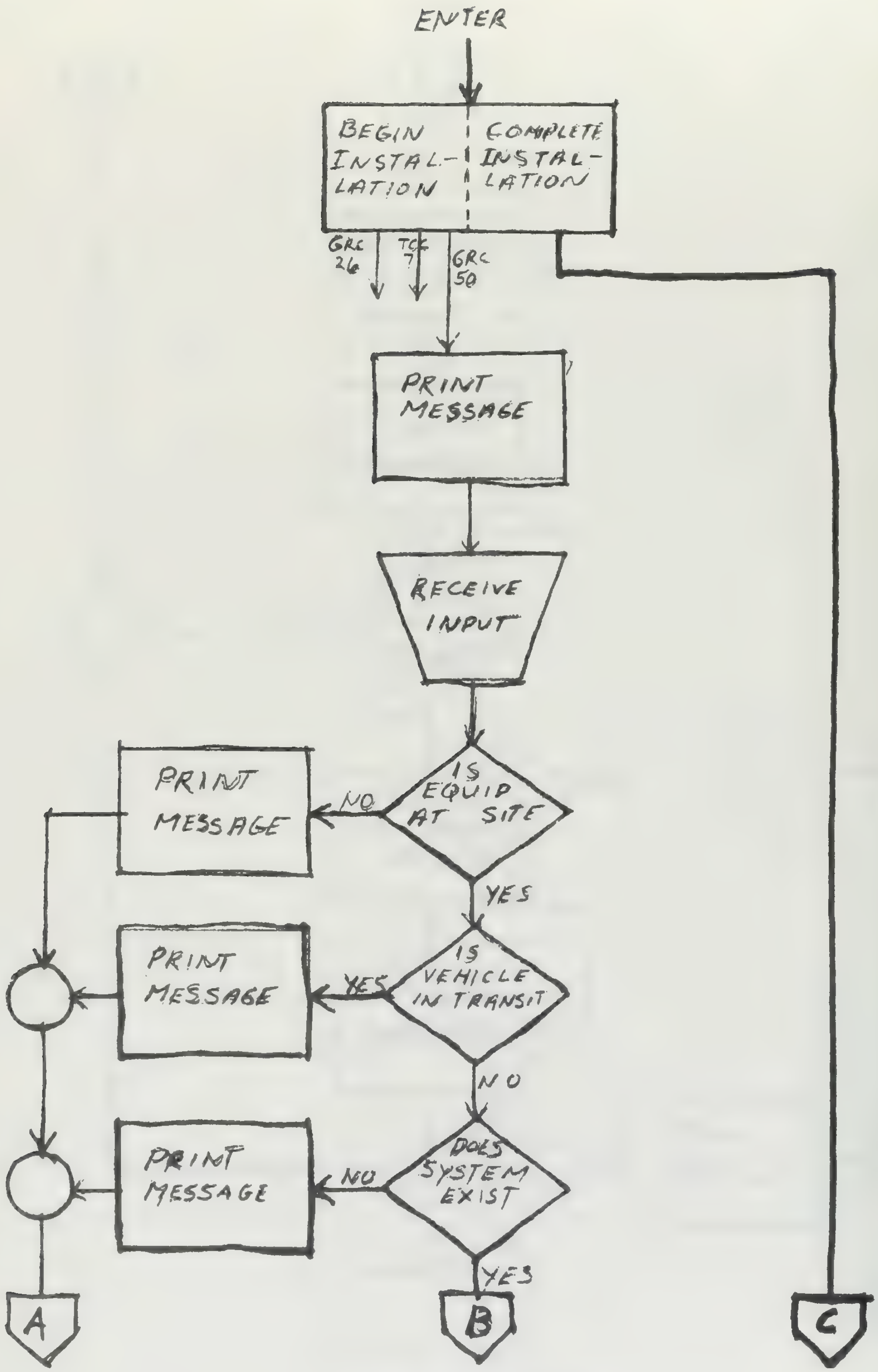


Subroutine EQREM

Figure 14

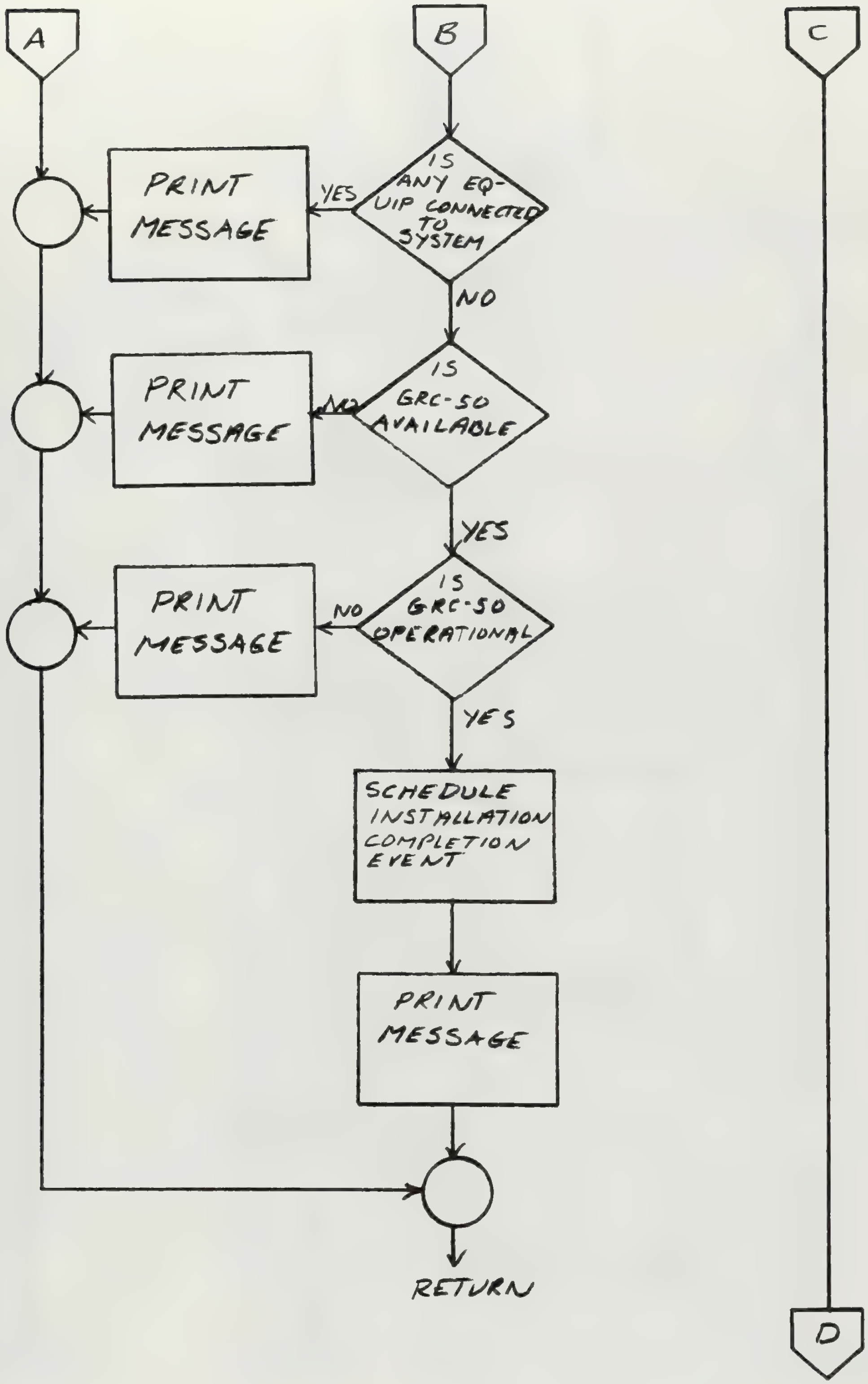


Subroutine EQREM (Cont.)

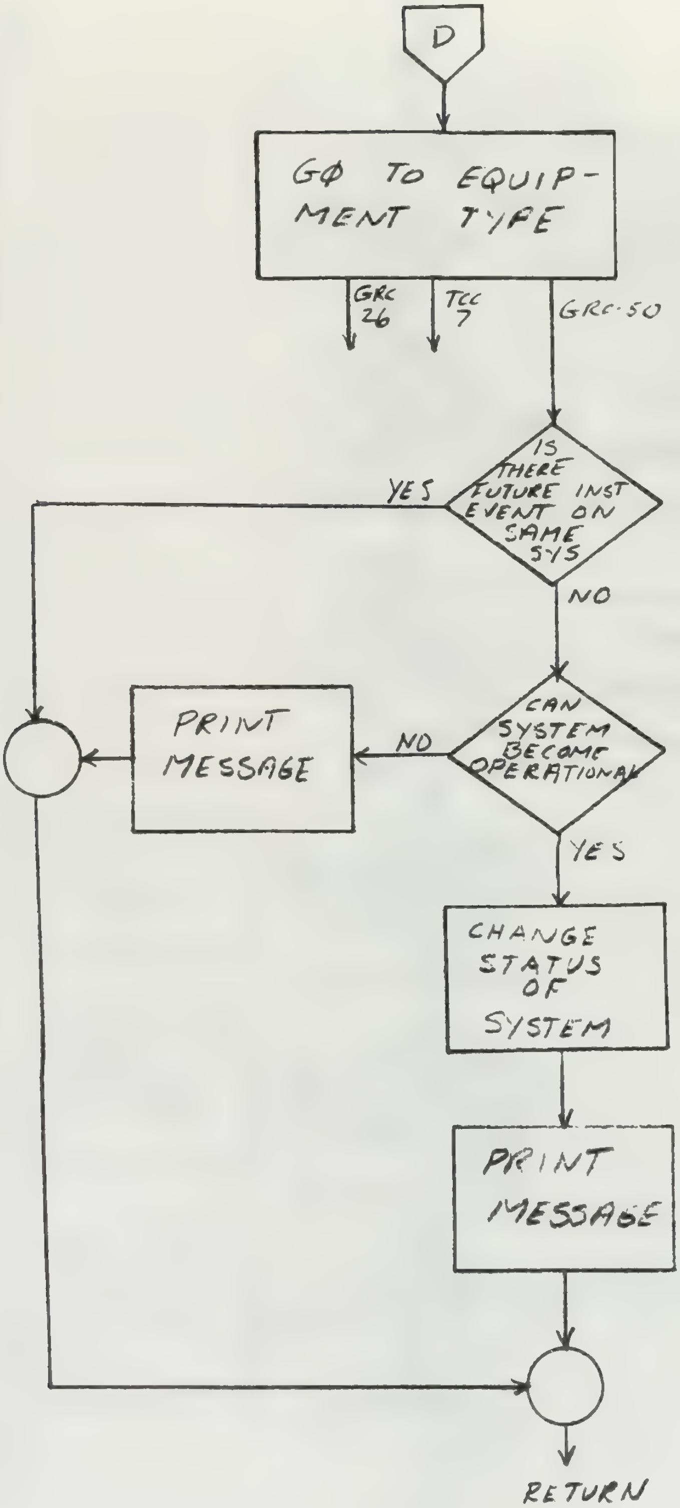


Subroutine EQINST

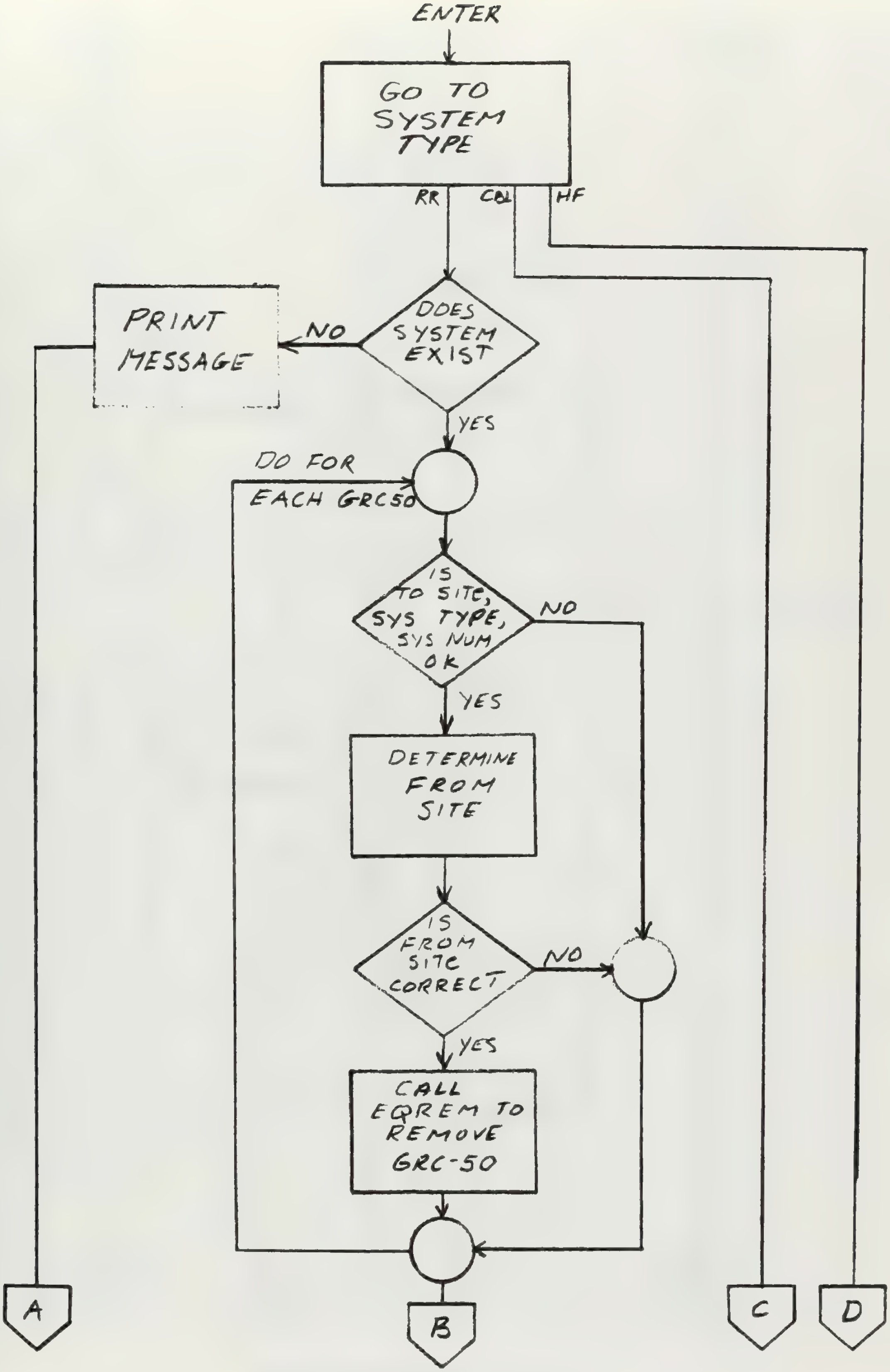
Figure 15



Subroutine EQINST (Cont.)

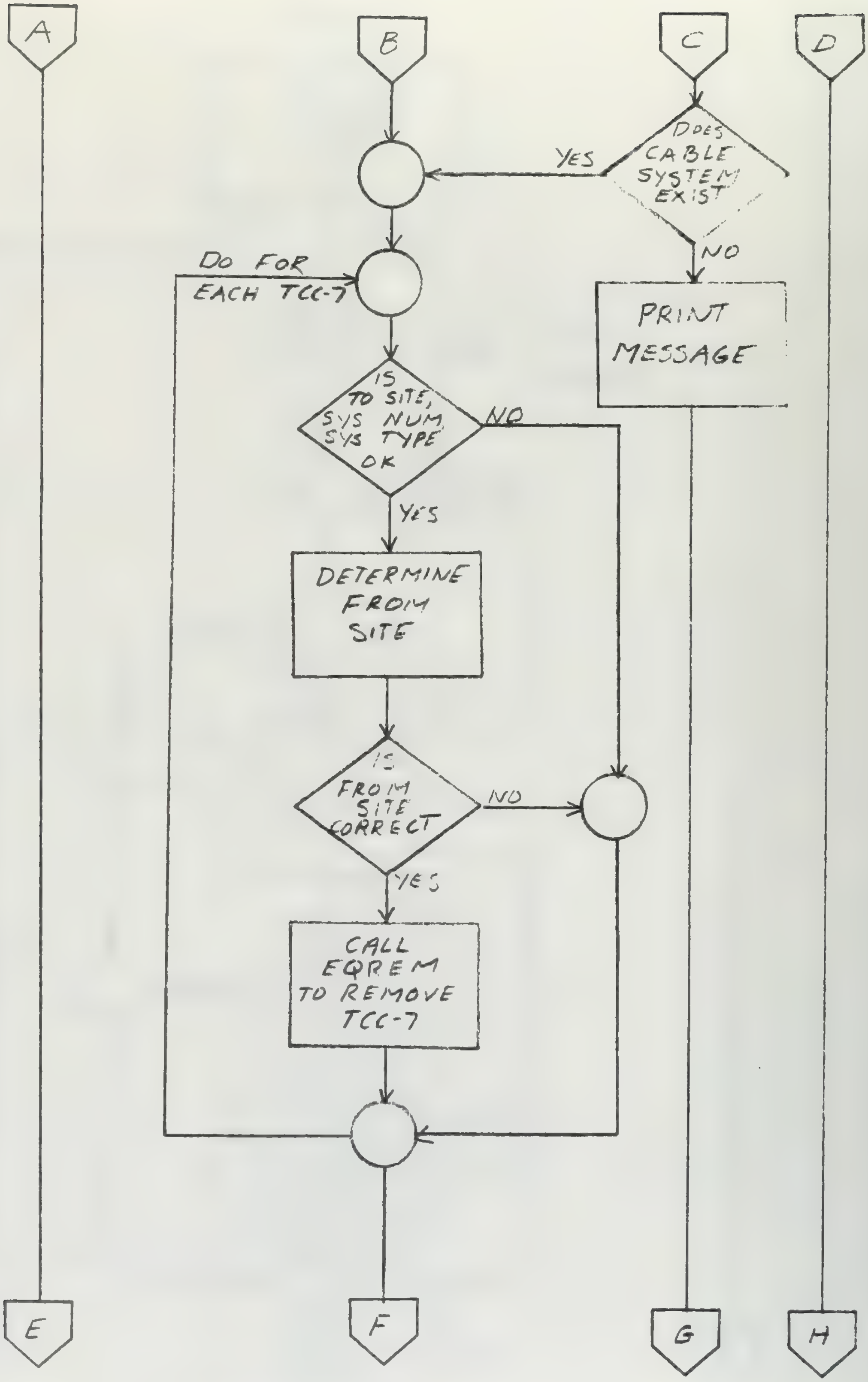


Subroutine EQINST (Cont.)

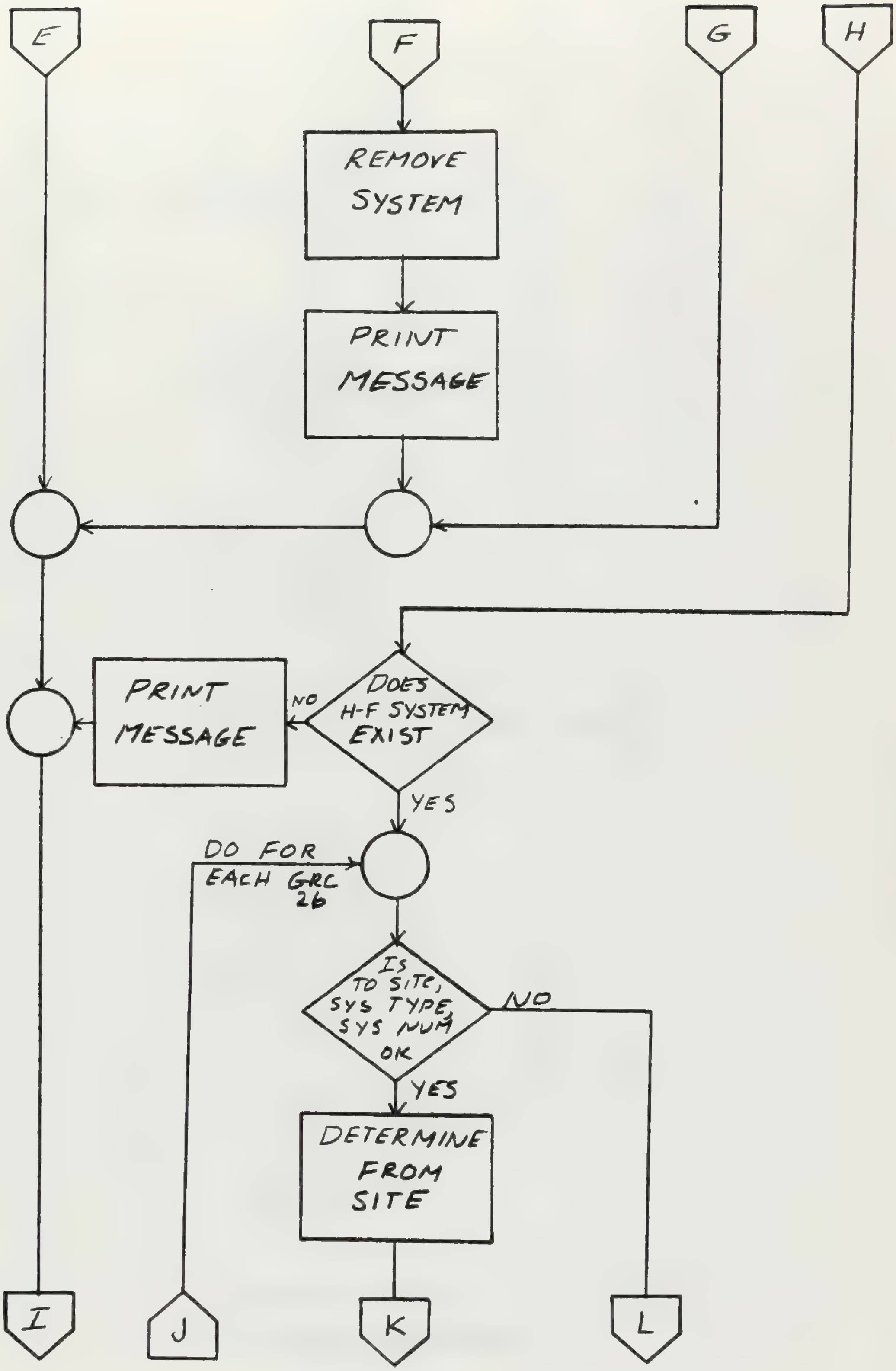


Subroutine SYSREM

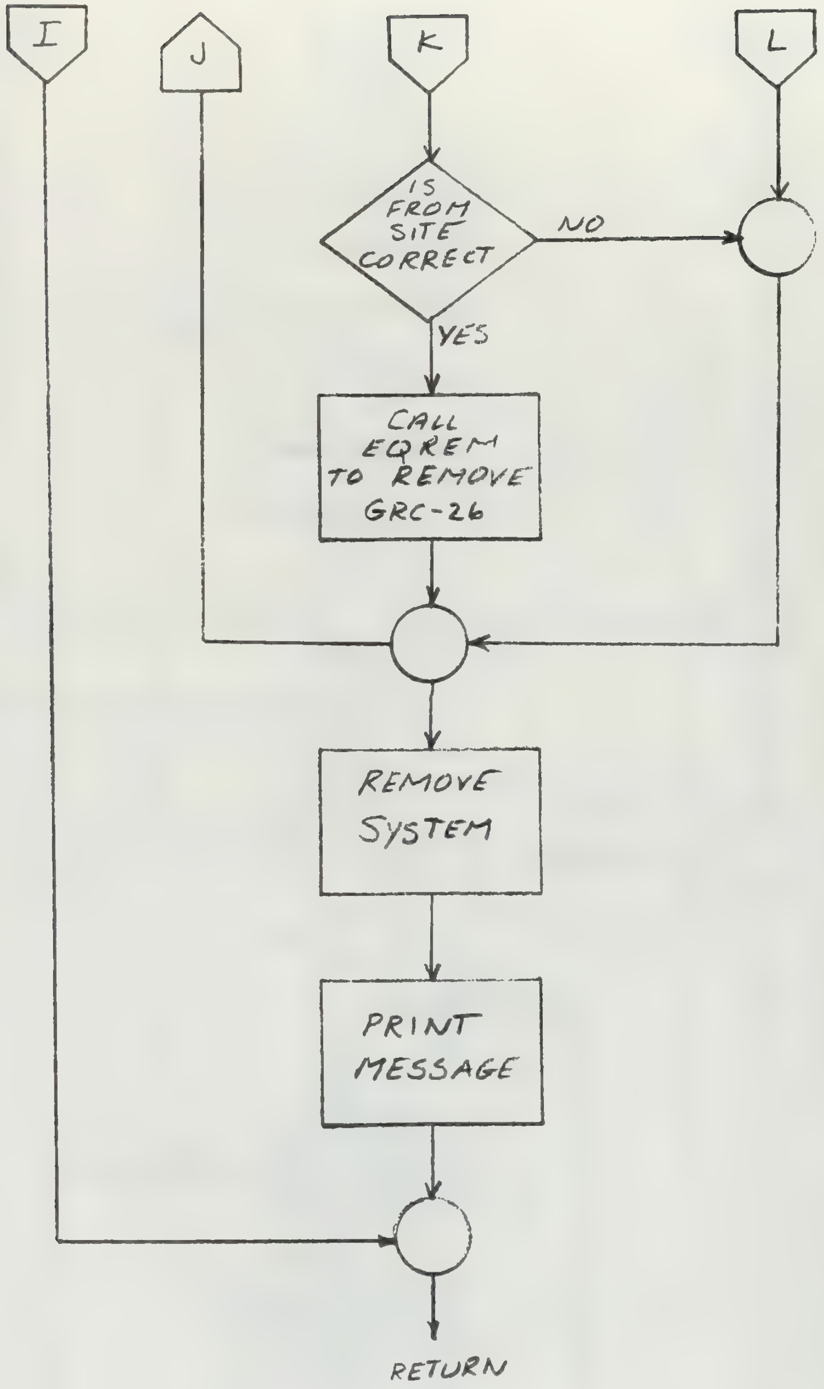
Figure 16



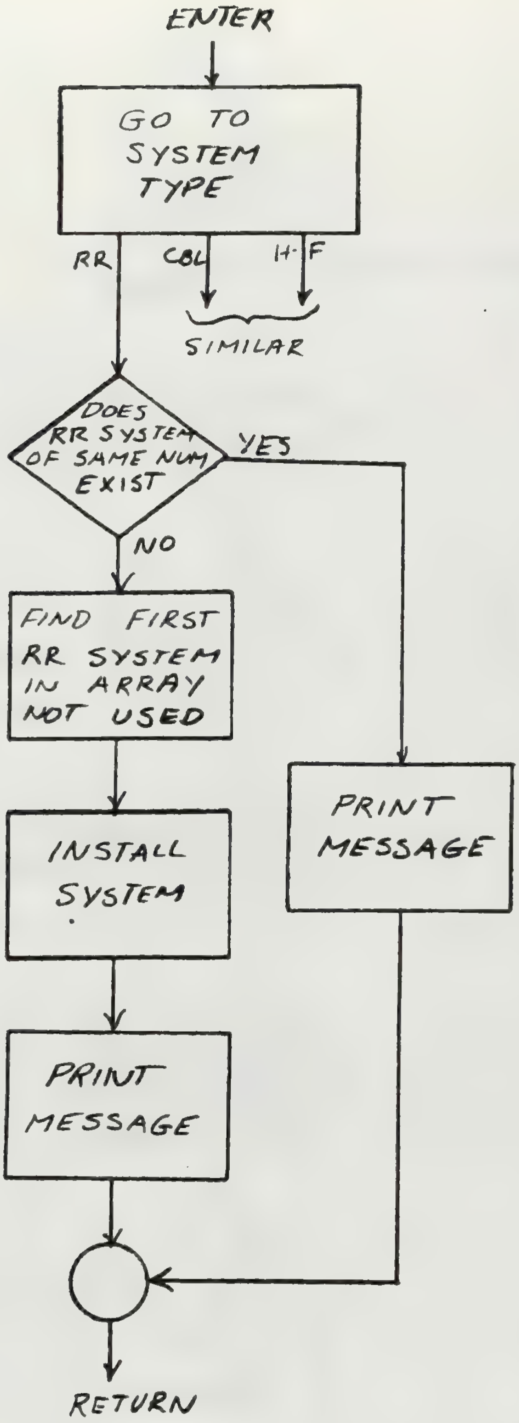
Subroutine SYSREM (Cont.)



Subroutine SYSREM (Cont.)

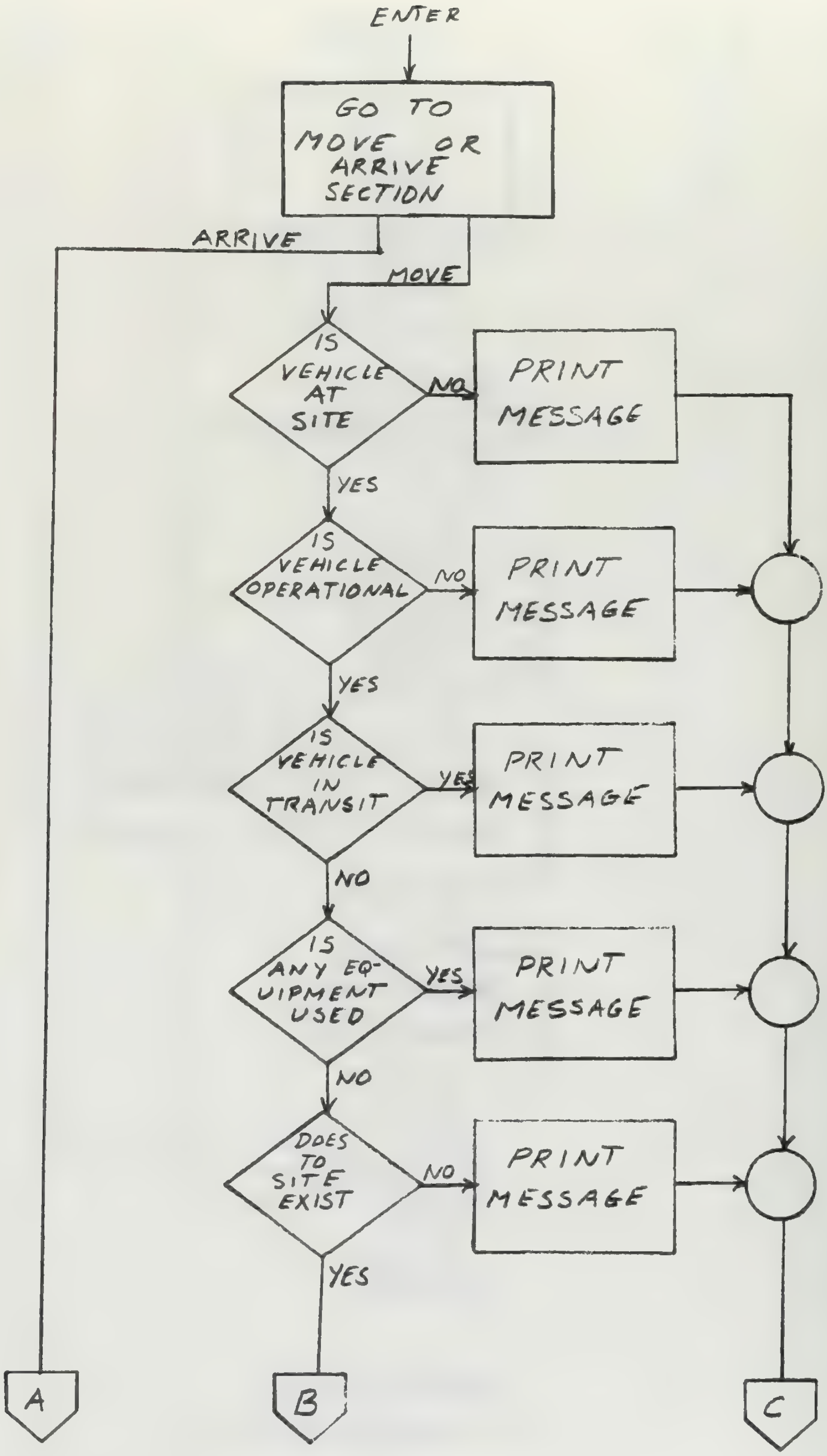


Subroutine SYSREM (Cont.)



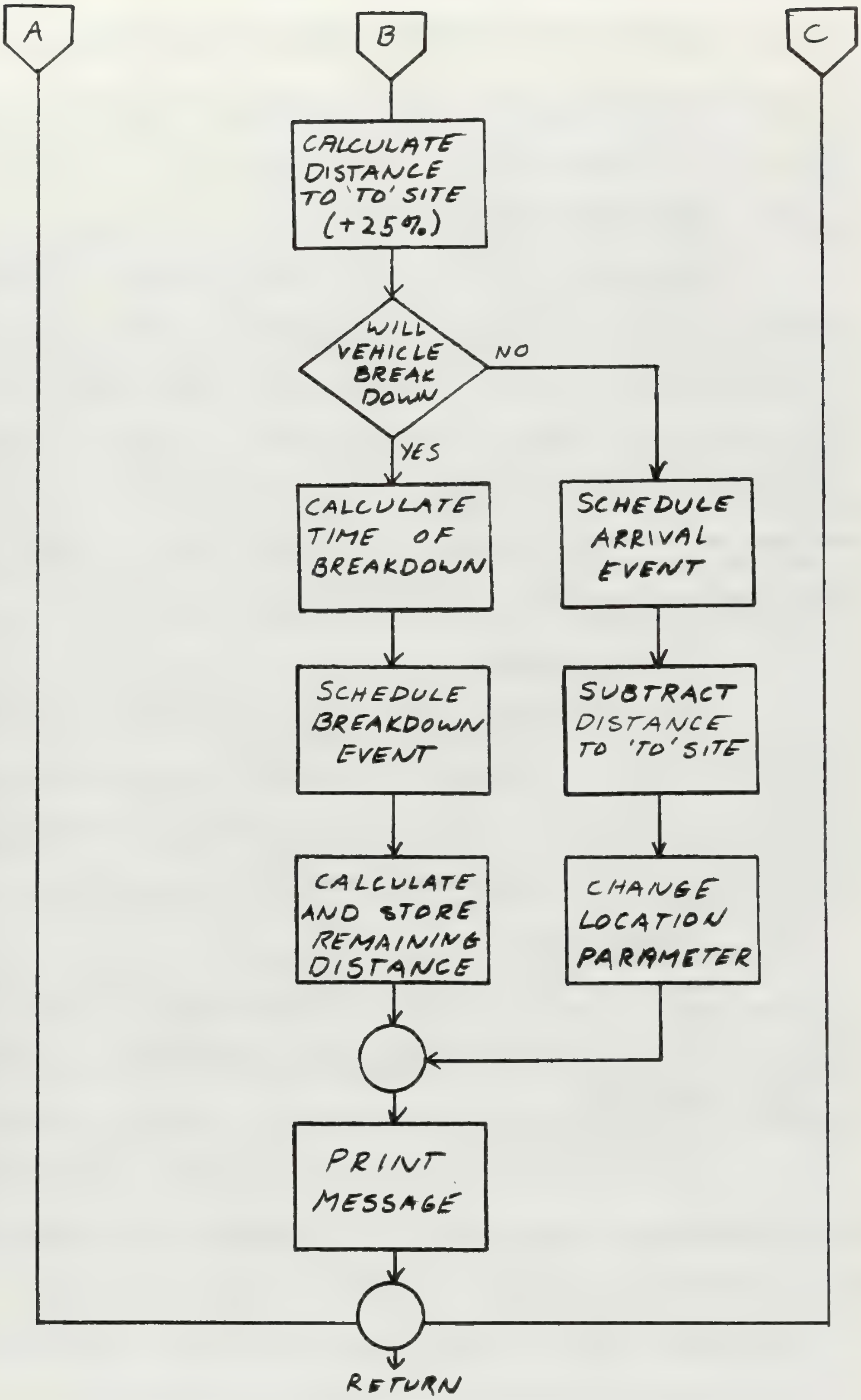
Subroutine SYINST

Figure 17



Subroutine VEHMOV

Figure 18


A
B
C
CALCULATE DISTANCE TO 'TO' SITE (+25%)
WILL VEHICLE BREAK DOWN
NO
YES
CALCULATE TIME OF BREAKDOWN
SCHEDULE ARRIVAL EVENT
SCHEDULE BREAKDOWN EVENT
SUBTRACT DISTANCE TO 'TO' SITE
CALCULATE AND STORE REMAINING DISTANCE
CHANGE LOCATION PARAMETER
PRINT MESSAGE
RETURN

Subroutine VEHMOV (Cont.)

If the vehicle breaks down enroute a breakdown event is scheduled and the remaining distance to travel is stored. Second it prints a message informing the players when a vehicle arrives and changes the transit parameter in the vehicle simulation unit.

22. Subroutines RANDU and GAUSS

Subroutine RANDU is an IBM supplied random number generator for use on the IBM 360 computer. It employs the power residue method of generating random numbers and has a cycle length much larger than that required by the game. Subroutine GAUSS is an IBM supplied subroutine which generates normally distributed samples adjusted to an input mean and standard deviation. The normal sample is formed from twelve random numbers from randu using the central limit theorem.

23. Subroutine ORDERT

Subroutine ORDERT is used to order the future events calander by time of event. If a single event is added to the calander it is placed initially in position one hundred by the subroutine generating it and subsequently placed in proper order when ORDERT is called.

24. Subroutine TIME

Subroutine TIME is used to convert the simulation play time which is stored in minutes to days, hours, and minutes for player use.

25. BLOCK DATA

The BLOCK DATA section is used for array initialization.

V. ADAPTING THE PROGRAM FOR OTHER APPLICATIONS

Four major types of simulation units are employed in the program: (1) equipment units, (2) vehicle units, (3) system units, and (4) site units. The information stored in arrays associated with each of these units completely describes the current status and deployment of all simulated equipment as well as future actions for each generated by the computer. Equipment units include radios and multiplexers while vehicle units include communications vehicles and generators. System units provide information on the three types of systems and site units do the same for communications sites. By changing the equipment associated with the program units, along with array size and possibly employment rules, the same basic program may be used for other applications.

The easiest conversion, that is the one requiring fewest program changes, would be adapting the program to other signal organizations. Since the Division Signal Battalion, Airborne Division Signal Battalion, Army Area Signal Battalion, Airborne Corps Signal Battalion, and Army Command Radio and Cable Battalion all perform similar missions with similar equipment, major changes in the current program would include only array sizes and assignment proceedures. All program units would still represent equipment or systems performing the functions currently assigned to them.

The program may be modified to simulate a power transmission system, either in peacetime or during conflict, by somewhat more extensive changes. Vehicle units might now represent major items of power generation or transmission equipment while equipment units represent components of these.

Systems could include different transmission methods or routes and sites the location where the generator or transmission equipment is located.

Transportation problems, including motor vehicle, railroad, or air, may also be simulated by appropriate changes. Vehicle units could include not only the carriers themselves but also bridges, underpasses, overpasses, major switches, and airport facilities as appropriate. Equipment units would be components of the vehicle units. Systems would correspond to the routes used and sites the garages, yards, or airports.

VI. SUGGESTED AREAS FOR FURTHER DEVELOPMENT

The two areas which appear the most promising subjects for further development of the program deal with increasing the level of detail and improving the accuracy of the internal parameters used.

Increased detail might prove useful in a number of areas. At present there is no check in the program to insure that radio line-of-sight exists for radio-relay systems. The burden of seeing that it is maintained is left to the instructor who supervises the play. Some preliminary investigation was made toward including this information in a binary matrix by grid location, but an efficient way to determine mutual line-of-sight properties between all points in the corps area of operations must be devised before this approach becomes practical.

In the current program only a defensive phase is included in addition to setup. Although movement of sites corresponding to an attack may be played it is likely, in actual combat, that the level of conflict would increase during an attack. Incorporating a change in the level of conflict would increase the realism of a simulated attack.

The current liklihood of a site being attacked is governed solely by the classification of the site as a relay site, a major terminal, or a minor terminal. Many other factors such as accessibility, proximity to front lines, and security provided will influence the safety of the site and therefore could be included.

A table of play statistics generated at game termination might prove to be a valuable measure of the effectiveness of student play although the stochastic nature of the game prevents any absolute scale from being used. Useful entries could include number of system failures, mean length of failure, number of vehicle movements, average distance moved, etc.

In the current program vehicles may fail during transit but they cannot be attacked. A more realistic approach might be to include both these factors and also provide a capability for changing the destination of a vehicle in transit.

Improving the accuracy of the internal constants which define the failure, repair, site attack, installation, and transit time distributions would be a whorthwhile, but difficult, task. Little firm data appears to be available in most of these areas and, as a result, much of it was based on a limited sample of military judgement. Even if firm data is not available more accurate parameters could be obtained by a larger sample of military communicators experienced in corps communications.

APPENDIX A

INTRODUCTION TO ARMY CORPS COMMUNICATIONS

A. GENERAL

The purpose of this appendix is to present a quick overview of the communications capabilities of the Corps Signal Battalion for readers not familiar with signal corps organization and operation. The only aspects covered in any reasonable detail are those directly concerned with the construction of the game and readers interested in further explanation should consult references (2), (4), and (7).

Signal communications are provided for corps headquarters through command signal centers established at corps main, corps alternate, and corps tactical (when employed) command posts. Each of these signal centers provides a communications center for processing printed classified messages, telephone switching, teletype terminal facilities, and radio wire integration facilities for interfacing radio and telephone circuits. Facsimilie (image transmission) and teletype tape relay facilities are provided at corps main and corps alternate only. Scheduled messenger, both motor and air, is provided from corps main and alternate to other signal centers, to subordinate division command posts, and to other major subordinate commands of the corps. Special (unscheduled) messenger service is provided at each command signal center. Additional facilities, such as automatic data processing, may be provided if authorized.

Messages transmitted electronically between corps and subordinate unit headquarters are usually transmitted on either multichannel radio-relay systems, multichannel cable systems, or high frequency radio nets.

A short description and some advantages and disadvantages of each is discussed below.

Radio-relay systems are the primary means of communications within a corps and each system is capable of simultaneously transmitting and receiving twelve telephone conversations. A system of this type requires a radio located near each of the headquarters being supported and the radios operate in a frequency range requiring radio line-of-sight between transmitter and receiver (the system cannot operate if the transmitter and receiver have obsticals blocking a straight line path). As a result, relay sites are often required in mountainous or uneven terrain. The distance between radios on this type of system should normally not exceed thirty miles. The advantages of radio-relay systems include high message density capability and relatively short installation times (approx. thirty minutes). Disadvantages include relatively easy interception of messages and the need for isolated relay sites on long or difficult systems.

Multichannel cable systems are capable of simultaineously transmitting and receiving twelve telephone circuits using a four conductor cable between the system end points. The cable may be run overhead or placed directly on the ground and for long systems unattended or attended repeaters may be required. Since distances between headquarters in the corps area of operations are large multichannel cable systems are not frequently used. Advantages of multichannel cable include high message density and security from message interception. Disadvantages are long installation time, the need for attended repeaters on long systems, and susceptability to breakage of the cable by friendly troops.

A high frequency (H-F) radio net established by the Corps Signal Battalion typically contains from three to seven different stations capable of communicating with each other on the same frequency. One voice circuit and one teletype circuit can be transmitted simultaneously and the battalion is capable of installing a number of H-F nets. Advantages of H-F include quick setup times (approx. ten minutes) and no requirement for repeaters. Disadvantages include low message density and ease of interception.

The placement of communications equipment at a supported headquarters usually involves establishing two signal locations. One of these, commonly referred to as radio-relay hill, is located on a high piece of terrain near the supported headquarters and contains those radios requiring line-of-sight and other radios having transmission difficulties. Equipment such as telephone switching, message centers, etc., are usually placed in the supported headquarters compound and connected to radio-relay hill by cable.

Only the communications equipment and vehicles necessary for establishing the three types of communications systems described above were included in the game for placement and failure. This was due both to the time constraint on program construction and the fact that these items constitute the bulk of communications equipment which commonly fail and are frequently moved. Equipment such as telephone exchanges, communications centers, and teletype tape relays are provided only for specific headquarters and little reorganization or moving will occur in combat.

B. COMMUNICATIONS EQUIPMENT NEEDED FOR SYSTEMS

The following section provides a brief description of the vehicles and equipment necessary to establish the three types of communications systems installed by the Corps Signal Battalion.

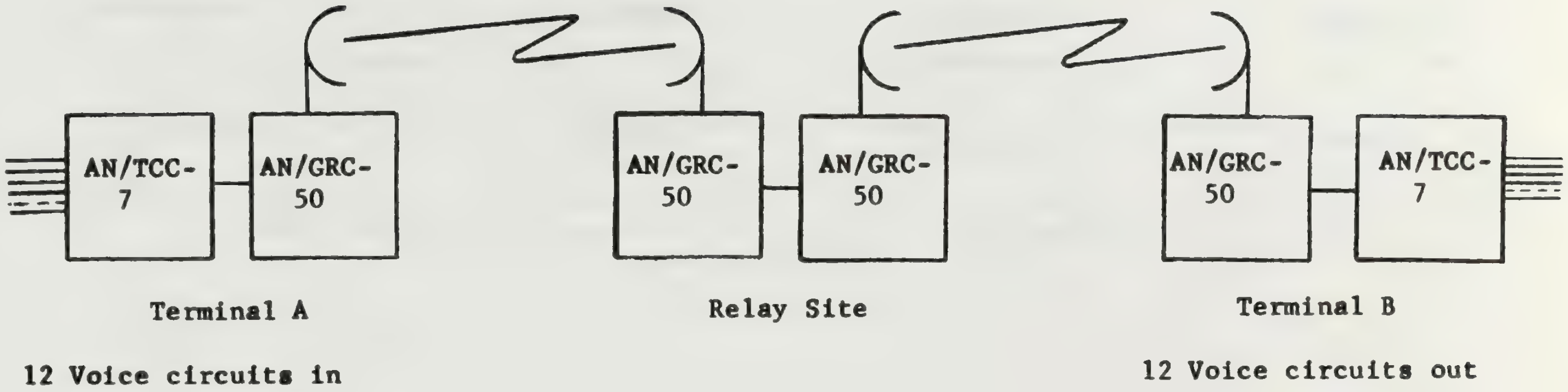
A radio-relay system with no relay sites requires at each terminal one AN/GRC-50 radio and one AN/TCC-7 multiplexer. The purpose of the multiplexer is to combine the twelve voice circuits into a single band for transmission and to separate the voice circuits upon reception. The radio receives the signal to be transmitted from the multiplexer by cable and transmits it to a radio at the other site. The radio at the other site feeds the received signal to its associated multiplexer also by cable. Each radio and multiplexer is capable of receiving and transmitting simultaneously.

Each radio-relay site inserted in a radio-relay system requires two AN/GRC-50 radios - one to operate with adjacent sites on either side. No multiplex equipment is required since it is necessary to have intelligible voice circuits only at the terminals.

A multichannel cable system requires one AN/TCC-7 multiplex unit located at each of the supported headquarters the cable system connects. The purpose of the multiplexer is the same as in radio relay systems. Spiral Four (four conductor) cable is used to connect the multiplexers with AN/TCC-11 (unattended) and AN/TCC-8 (attended) repeaters placed as required at specified intervals along the cable. The program presented in this thesis does not consider placement or failure of repeaters for cable systems.

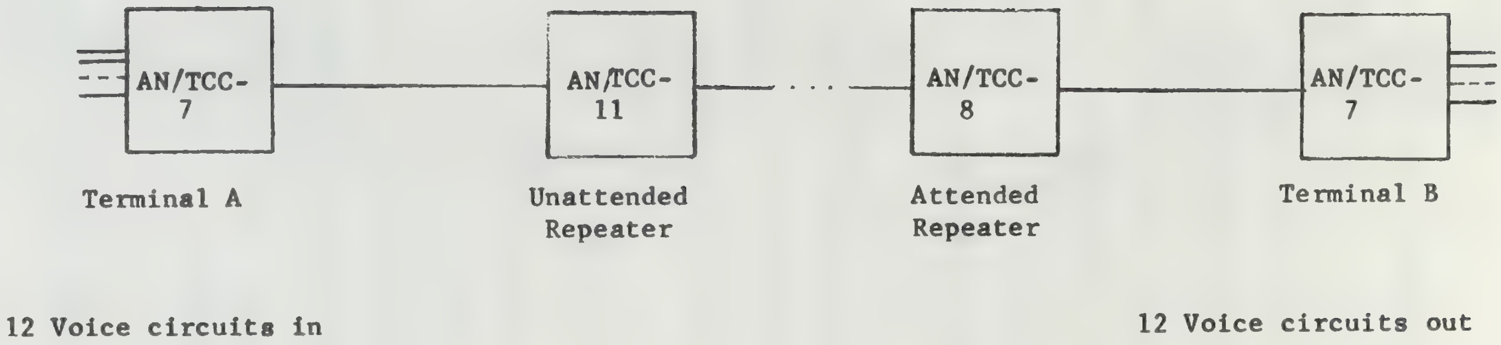
High frequency nets require one AN/GRC-26 radio at each of the headquarters using the net.

Figures 19 through 21 provide an illustration of the type of equipment required for typical systems of each type.



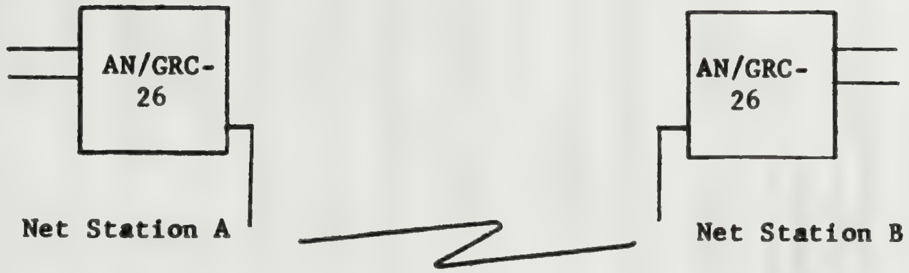
Example of
Radio Relay System

Figure 19



Example of
Multichannel Cable System

Figure 20



Example of
High Frequency System

Figure 21

C. COMMUNICATIONS VEHICLES

Four types of communications vehicles are organic to the Corps Signal Battalion to provide equipment for installation of systems. The vehicles and major equipment contained are listed in Table V below.

Vehicle Name	Number	Description	Equipment
AN/MRC-102	22	Radio Terminal	one AN/TCC-7 two AN/GRC-50
AN/MRC-103	32	Radio Repeater	three AN/GRC-50
AN/MCC-6	17	Telephone Teleg Terminal	two AN/TCC-7
AN/GRC-26	21	Radio Terminal	one AN/GRC-26

*AN/TCC-50 in AN/MCC-6 is considered identical to AN/TCC-7 for game.

MAJOR EQUIPMENT CONTAINED IN COMMUNICATIONS VEHICLES

TABLE V

Although any vehicle combination containing the equipment needed for establishing a system may be used to support any headquarters, special considerations not discussed here usually cause AN/MRC-103's and AN/MCC-6's to be used for radio-relay terminals at corps main, alternate, and artillery headquarters while AN/MRC-102's are used for radio-relay terminals at other headquarters. Model systems interconnection plans, commonly called doctrinal systems, which specify the recommended number and type of systems connecting major headquarters in the corps area have been developed. Details of these systems can be found in Reference (2).

APPENDIX B

TACTICAL SCENARIO FOR GAME

A. GENERAL

The tactical scenario described in this appendix is a condensed version of the scenario used in the Corps Communications Practical Exercise at the Signal Officers Advanced Course. The offensive portion of the scenario has been deleted since only the defensive portion is used for the game. For the complete scenario readers should consult Reference (7).

B. STRATEGIC SITUATION

Aggressor forces initiated general war against the North Atlantic Treaty Organization (NATO) last year during the month of September. The outbreak of the war was preceeded by a period of increasing diplomatic tension, and as a result, the NATO forces were deployed. To secure his southern flank Aggressor respected the neutrality of Austria, Switzerland, and Yugoslavia. The Aggressor gound attack was preceeded by large scale strategic nuclear bombing of cities and military installations in Western Europe and North America, which initially rendered the United States incapable of reinforcing its forces in Europe. The Aggressor armies and air force, employing tactical nuclear weapons on a large scale, rapidly pushed the NATO forces across France west of the Rhine River. The lines of communication across France were nearly destroyed and approximately seventy-five percent of the NATO airfields in Western Europe and North America were rendered inoperable. However, NATO retaliatory operations against the Aggressor homeland and his lines of communication were extremely effective and reinforcement of Aggressor's initial attack was not possible on a large scale. The land battle in West Germany and at the Rhine defensive line resulted in such losses to both forces that all large scale movement came to a halt during the fall months. During the winter the Rhine defenses held firm and the conditions in the rear of Aggressor forces deteriorated badly as a result of satellite unrest and the destruction of his homeland. During the same period the United States was partially able to rebuild its forces in NATO and a large, but inadequately equipped, French Army was mobilized. The surviving West German forces, constituting a four division corps and supporting forces, became part of this army. Strategic intelligence indicated this spring that, if NATO could take the offensive and linkup with resistance movements in Germany and Czechoslovaki mass uprisings would occur in these and other satellite countries and Aggressor resistance would collapse. By this time the buildup of NATO tactical air forces and the intensive campaign against Aggressor nuclear delivery means had given NATO an offensive capability.

C. GROUND SITUATION

1. NATO Forces

The 30th (US) Army, a part of the Central Army Group, crossed the Rhine River on 3 July. The attack was initiated with numerous nuclear attacks east of the Rhine. By exploiting the effects of these weapons, NATO forces were able to advance rapidly toward the cities of Kassel, Nurnberg, and Munchen. However, Aggressor resistance began to stiffen on 8 August along the entire front. 30th (US) Army was ordered to assume a defensive posture east of the Altmuhl and Wertach Lech Rivers. Preparations are being made to continue the attack on 16 August to seize crossing sites over the Ludwigs Kanal to ensure the rapid advance of NATO forces to border areas where linkup with guerrilla forces will be accomplished.

2. 1st (US) Corps

The 1st (US) Corps, a part of the 30th Army is organized as a four division corps with supporting troops. On 10 August the attacking elements of the corps were ordered to assume a defensive posture along the Wornitz River in order to reorganize and resupply prior to continuing the attack on 16 August. Units average approximately 85 percent strength but, because of equipment shortages, are considered only 75 percent combat effective. There has been a continuing shortage of all supplies, replacement personnel, and equipment. Since the Rhine crossing most replacement of personnel and equipment have come from the cannibalization of battle damaged units. However, 30th Army has indicated that all corps signal units will receive personnel and equipment to fill all existing TOE shortages prior to 16 August.

D. REQUIREMENT

Acting as the 1st (US) Corps Signal Battalion commander and staff you are to locate signal sites, place communications equipment, and install systems in the corps area of operations to support the corps during the defensive phase. Subsequent to initial installation you are to take whatever action necessary to maintain these communications to the best of your ability.

COMPUTER PROGRAM

This section of the thesis provides a listing of the computer assisted game which was developed.

```
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR                    MAI00010
C                                                                       MAI00020
      CALL INPT                                                         MAI00030
C                                                                       MAI00040
      CALL ASSIGN                                                       MAI00050
C                                                                       MAI00060
      CALL TABLE(0)                                                     MAI00070
C                                                                       MAI00080
      CALL GENTAB(0)                                                    MAI00090
C                                                                       MAI00100
C     INITIALIZE DAY AND TIME                                           MAI00110
      IDAY=1                                                            MAI00120
      ITIME=0                                                           MAI00130
C     IF CALENDER OF FUTURE EVENTS DOESNT HAVE 50 EVENTS ADD EVENTS     MAI00140
    2 IF(IEVCAL(50).NE.0)GO TO 1                                        MAI00150
      CALL SEARCH                                                       MAI00160
C     IS NEXT SCHEDULED EVENT LESS THAN 30 MINUTES AWAY                 MAI00170
    1 IF(JEVCAL(1)-ITIME.LE.30)GO TO 3                                  MAI00180
C     UPDATE SIMULATION TIME                                            MAI00190
      ITIME=ITIME+30                                                    MAI00200
      CALL UPDATE(30)                                                   MAI00210
      GO TO 4                                                           MAI00220
C     DESIGNATE NEXT EVENT AS CURRENT EVENT                             MAI00230
    3 IEVCUR=IEVCAL(1)                                                  MAI00240
      ISUB=JEVCAL(1)-ITIME                                              MAI00250
      ITIME=JEVCAL(1)                                                   MAI00260
C     TOP JUSTIFY FUTURE EVENTS CALENDER                                MAI00270
      DO 5 I=2,100                                                      MAI00280
      JEVCAL(I-1)=JEVCAL(I)                                             MAI00290
    5 IEVCAL(I-1)=IEVCAL(I)                                             MAI00300
      IEVCAL(100)=0                                                     MAI00310
      JEVCAL(100)=0                                                     MAI00320
C     UPDATE SIMULATION TIME                                            MAI00330
      CALL UPDATE(ISUB)                                                 MAI00340
C     PERFORM ACTIONS CALLED FOR BY CURRENT EVENT                       MAI00350
    9 CALL SWITCH                                                       MAI00360
C     PRINT TIME                                                        MAI00370
    4 CALL TIME(ITIME,IDAY)                                             MAI00380
C     ACCEPT STUDENT DECISION                                           MAI00390
      WRITE(6,6)                                                        MAI00400
    6 FORMAT(/' ENTER DECISION'/' XXX')                                 MAI00410
      READ(5,7)IEVCUR                                                   MAI00420
    7 FORMAT(I3)                                                        MAI00430
      WRITE(6,8)IEVCUR                                                  MAI00440
    8 FORMAT(I4//)                                                      MAI00450
C     IF DECISION REQUIRES ACTION TAKE IT                               MAI00460
      IF(IEVCUR.EQ.0) GO TO 2                                           MAI00470
      GO TO 9                                                           MAI00480
```

```
C                                                                       MAIO0490
      END                                                               MAIO0500
      SUBROUTINE INPT                                                   INPO0010
C                                                                       INPO0020
C                                                                       INPO0030
C     THIS SUBROUTINE IS USED FOR INITIAL PLACEMENT OF COMMUNICATIONS   INPO0040
C     EQUIPMENT AND INSTALLATION OF RADIO AND CABLE SYSTEMS FOR         INPO0050
C     THE DEFENSE                                                       INPO0060
C                                                                       INPO0070
C                                                                       INPO0080
      COMMON/C1/LOCSIT (30), IM102 (22),IM103 (32),IMCC6 (17),IV26 (21),INPO0090
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS   ( INPO0100
     210),IDUM1 (30),IGEN (54),LOCHC(22)                                INPO0110
      COMMON/C3/IREAD,IWRITE                                            INPO0120
      COMMON/C4/IG50FL(140),IT7FL(56),IG26FL(21),IGENFL(54)             INPO0130
      COMMON/C6/IX                                                      INPO0140
C                                                                       INPO0150
C     ENTER GAMEWORD AND SET LOGICAL UNIT NUMBERS FOR INPUT AND         INPO0160
C     OUTPUT DEVICES                                                    INPO0170
C                                                                       INPO0180
      WRITE(6,200)                                                      INPO0190
  200 FORMAT(//' INPUT GAMEWORD'/' XX')                                 INPO0200
      READ(5,201)IREAD,IWRITE                                           INPO0210
  201 FORMAT(2I1)                                                       INPO0220
      WRITE(6,206)                                                      INPO0230
  206 FORMAT(/' INPUT ODD RANDOM NUMBER'/' XXXXXXX')                    INPO0240
      READ(5,207)IX                                                     INPO0250
  207 FORMAT(I7)                                                        INPO0260
      IF(IREAD.EQ.0)GO TO 210                                           INPO0270
      WRITE(6,202)                                                      INPO0280
  202 FORMAT(/' INPUT IS ENTERED BY CARDS')                             INPO0290
  210 IF(IWRITE.EQ.0)GO TO 211                                          INPO0300
      WRITE(6,204)                                                      INPO0310
  204 FORMAT(/' COMPLETE SYSTEM AND GENERATOR TABLES ARE PRINTED BY HIGHINPO0320
     1 SPEED PRINTER')                                                  INPO0330
      GO TO 212                                                         INPO0340
  211 WRITE(6,205)                                                      INPO0350
  205 FORMAT(/' COMPLETE SYSTEM TABLE IS PRINTED AT TERMINAL')          INPO0360
  212 IN=5                                                              INPO0370
      IOUT=6                                                            INPO0380
      IF(IREAD.EQ.1)IN=4                                                INPO0390
      IF(IREAD.EQ.1)IOUT=7                                              INPO0400
C                                                                       INPO0410
C                                                                       INPO0420
      WRITE(IOUT,1)                                                     INPO0430
C                                                                       INPO0440
```

```
C       INPUT NUMBER AND LOCATION OF COMMUNICATIONS SITES                 INP00450
C                                                                         INP00460
    1 FORMAT(//3X,'*** GAME INITIALIZATION ***'///6X,'* SITE INFORMATIONINP00470
     1 *'//' NUMBER OF SITES ='/' XX ')                                   INP00480
      READ(IN,2)NSITES                                                    INP00490
    2 FORMAT(I2)                                                          INP00500
      WRITE(IOUT,3)NSITES                                                 INP00510
    3 FORMAT(I3/)                                                         INP00520
C                                                                         INP00530
      DO 10 I=1,NSITES                                                    INP00540
      WRITE(IOUT,4)I                                                      INP00550
    4 FORMAT(/' SITE',I3,' LOCATION'/' XXXXXX ')                          INP00560
      READ(IN,5)LOCSIT (I)                                                INP00570
    5 FORMAT(I6)                                                          INP00580
   10 WRITE(IOUT,62)LOCSIT (I)                                            INP00590
   62 FORMAT(I7)                                                          INP00600
C                                                                         INP00610
   12 WRITE(IOUT,6)                                                       INP00620
    6 FORMAT(' DO YOU WISH TO CHANGE SITES OR LOCATIONS ? (NO = 0, YES =INP00630
     1 1)'/' X ')                                                         INP00640
      READ(IN,7)ICH                                                       INP00650
    7 FORMAT(I1)                                                          INP00660
      WRITE(IOUT,7)ICH                                                    INP00670
      IF (ICH.NE.1) GO TO 11                                              INP00680
      WRITE(IOUT,9)                                                       INP00690
    9 FORMAT(/' SITE NUMBER CHANGED ='/' XX ')                            INP00700
      READ(IN,2)II                                                        INP00710
      WRITE(IOUT,3)II                                                     INP00720
      WRITE(IOUT,4)II                                                     INP00730
      READ(IN,5)LOCSIT (II)                                               INP00740
      WRITE(IOUT,62)LOCSIT (II)                                           INP00750
      GO TO 12                                                            INP00760
   11 CONTINUE                                                            INP00770
C                                                                         INP00780
C       INPUT MULTICHANNEL RADIO RELAY SYSTEMS                            INP00790
C                                                                         INP00800
      IDSYS=1                                                             INP00810
      WRITE(IOUT,61)                                                      INP00820
   61 FORMAT(//3X,'*** MULTICHANNEL RADIO RELAY SYSTEMS ***'//' NUMBER OINP00830
     1F MULITICHANNEL LINKS ='/' XX ')                                    INP00840
      READ(IN,2)NSYS                                                      INP00850
      WRITE(IOUT,3)NSYS                                                   INP00860
      IF(NSYS.EQ.0) GO TO 23                                              INP00870
      WRITE(IOUT,14)                                                      INP00880
   14 FORMAT(/' NUM, FROM, TO'/' X XX XX')                                INP00890
      DO 13 I=1,NSYS                                                      INP00900
      READ(IN,15)NUM,IFROM,ITO                                            INP00910
   15 FORMAT(I1,1X,I2,1X,I2)                                              INP00920
```

```
      WRITE(IOUT,63)NUM,IFROM,ITO                                       INP00930
   63 FORMAT(I2,1X,I2,1X,I2/)                                           INP00940
   13 IRRSYS (I)=(NUM*10000+IFROM*100+ITO)*10                           INP00950
C                                                                       INP00960
C     ALLOWS FOR CHANGING OF COMMUNICATIONS SYSTEMS                     INP00970
C                                                                       INP00980
   26 WRITE(IOUT,16)                                                    INP00990
   16 FORMAT(/' DO YOU WISH TO CHANGE ANY SYSTEM ? (NO = 0, YES = 1)'/' INP01000
     1X ')                                                              INP01010
      READ(IN,7)ICH                                                     INP01020
      WRITE(IOUT,7)ICH                                                  INP01030
      IF(ICH.EQ.1) GO TO 17                                             INP01040
      GO TO (23,24,25),IDSYS                                            INP01050
   17 WRITE(IOUT,18)                                                    INP01060
   18 FORMAT(/' SEQUENCE NUMBER OF SYSTEM (1,2,3,...) ='/' XX ')        INP01070
      READ(IN,2)I                                                       INP01080
      WRITE(5,2)I                                                       INP01090
      WRITE(IOUT,14)                                                    INP01100
      READ(IN,15)NUM,IFROM,ITO                                          INP01110
      WRITE(IOUT,63)NUM,IFROM,ITO                                       INP01120
      IDUM=(NUM*10000+IFROM*100+ITO)*10                                 INP01130
      GO TO (19,20,21),IDSYS                                            INP01140
   19 IRRSYS (I)=IDUM                                                   INP01150
      GO TO 22                                                          INP01160
   20 IHFSYS (I)=IDUM                                                   INP01170
      GO TO 22                                                          INP01180
   21 ICBSYS (I)=IDUM                                                   INP01190
   22 GO TO 26                                                          INP01200
C                                                                       INP01210
C     INPUT HIGH FREQUENCY RADIO SYSTEMS                                INP01220
C                                                                       INP01230
   23 IDSYS=2                                                           INP01240
      WRITE(IOUT,30)                                                    INP01250
   30 FORMAT(//3X,'*** H-F RADIO SYSTEMS ***'//' NUMBER OF H-F SYSTEMS =INP01260
     1'/' XX ')                                                         INP01270
      READ(IN,2)NSYS                                                    INP01280
      WRITE(IOUT,3)NSYS                                                 INP01290
      IF(NSYS.EQ.0) GO TO 24                                            INP01300
      WRITE(IOUT,14)                                                    INP01310
      DO 27 J=1,NSYS                                                    INP01320
      READ(IN,15)NUM,IFROM,ITO                                          INP01330
      WRITE(IOUT,63)NUM,IFROM,ITO                                       INP01340
   27 IHFSYS (J)=(NUM*10000+IFROM*100+ITO)*10                           INP01350
      GO TO 26                                                          INP01360
C                                                                       INP01370
C     INPUT MULTICHANNEL CABLE SYSTEMS                                  INP01380
C                                                                       INP01390
   24 IDSYS=3                                                           INP01400
```

```
      WRITE(IOUT,28)                                                    INP01410
   28 FORMAT(//3X,'***SPIRAL-4 CABLE SYSTEMS ***'//' NUMBER OF CABLE SYSINP01420
     1EMS ='/' XX ')                                                    INP01430
      READ(IN,2)NSYS                                                    INP01440
      WRITE(IOUT,3)NSYS                                                 INP01450
      IF(NSYS.EQ.0) GO TO 25                                            INP01460
      WRITE(IOUT,14)                                                    INP01470
      DO 29 K=1,NSYS                                                    INP01480
      READ(IN,15)NUM,IFROM,ITO                                          INP01490
      WRITE(IOUT,63)NUM,IFROM,ITO                                       INP01500
   29 ICBSYS (K)=(NUM*10000+IFROM*100+ITO)*10                           INP01510
      GO TO 26                                                          INP01520
C                                                                       INP01530
   25 CONTINUE                                                          INP01540
C                                                                       INP01550
C     INPUT LOCATIONS OF COMMUNICATIONS VEHICLES AND GENERATORS         INP01560
C                                                                       INP01570
      DO 50 IDVEH=1,5                                                   INP01580
      L=0                                                               INP01590
      GO TO (51,52,53,54,58),IDVEH                                      INP01600
   52 WRITE(IOUT,55)                                                    INP01610
   55 FORMAT(//3X,'*** MRC-103 ***'//' NUMBER OF SITES AT WHICH MRC-103'INP01620
     1'S ARE LOCATED ='/' XX ')                                         INP01630
      GO TO 48                                                          INP01640
   53 WRITE(IOUT,56)                                                    INP01650
   56 FORMAT(//3X,'*** MCC-6 ***'//' NUMBER OF SITES AT WHICH MCC-6''S AINP01660
     1RE LOCATED ='/' XX ')                                             INP01670
      GO TO 48                                                          INP01680
   54 WRITE(IOUT,57)                                                    INP01690
   57 FORMAT(//3X,'*** AN/GRC-26 ***'//' NUMBER OF SITES AT WHICH AN/GRCINP01700
     1-26''S ARE LOCATED ='/' XX ')                                     INP01710
      GO TO 48                                                          INP01720
   58 WRITE(IOUT,59)                                                    INP01730
   59 FORMAT(//3X,'*** GENERATORS ***'//' NUMBER OF SITES AT WHICH GENERINP01740
     1ATORS ARE LOCATED ='/' XX ')                                      INP01750
      GO TO 48                                                          INP01760
   51 WRITE(IOUT,31)                                                    INP01770
   31 FORMAT(//3X,'*** MRC-102 ***'//' NUMBER OF SITES AT WHICH MRC-102'INP01780
     1'S ARE LOCATED ='/' XX ')                                         INP01790
   48 READ(IN,2)N                                                       INP01800
      WRITE(IOUT,3)N                                                    INP01810
      IF(N.EQ.0) GO TO 50                                               INP01820
      DO 65 I=1,30                                                      INP01830
   65 IDUM1(I)=0                                                        INP01840
      WRITE(IOUT,33)                                                    INP01850
   33 FORMAT(/' SITE, NUM'/' XX XX')                                    INP01860
      DO 32 LL=1,N                                                      INP01870
      READ(IN,34)II,IDUM1(II)                                           INP01880
   34 FORMAT(I2,1X,I2)                                                   INP01890
   64 FORMAT(I3,1X,I2/)                                                  INP01900
   32 WRITE(IOUT,64)II,IDUM1(II)                                         INP01910
C     ALLOWS FOR CHANGING LOCATION OF VEHICLES AND GENERATORS            INP01920
C                                                                        INP01930
C                                                                        INP01940
   41 WRITE(IOUT,35)                                                     INP01950
   35 FORMAT(/' DO YOU WISH TO CHANGE ANY SITE/VEHICLE COMBINATIONS ? (NINP01960
     1O =0, YES = 1)'/' X ')                                             INP01970
      READ(IN,7)ICH                                                      INP01980
      WRITE(IOUT,7)ICH                                                   INP01990
      IF(ICH.EQ.0)GO TO 40                                               INP02000
      WRITE(IOUT,33)                                                     INP02010
      READ(IN,34)II,IDUM1(II)                                            INP02020
      WRITE(IOUT,64)II,IDUM1(II)                                         INP02030
      GO TO 41                                                           INP02040
C                                                                        INP02050
C     ASSIGNS COMMUNICATIONS VEHICLES AND GENERATORS BY ITEM NUMBER      INP02060
C     TO THE SITES                                                       INP02070
C                                                                        INP02080
   40 DO 42 J=1,30                                                       INP02090
      IF(IDUM1(J).EQ.0)GO TO 42                                          INP02100
      KK=IDUM1(J)                                                        INP02110
      DO 43 K=1,KK                                                       INP02120
      L=L+1                                                              INP02130
      GO TO (44,45,46,47,60),IDVEH                                       INP02140
   44 IM102(L)=100*J                                                     INP02150
      GO TO 43                                                           INP02160
   45 IM103(L)=100*J                                                     INP02170
      GO TO 43                                                           INP02180
   46 IMCC6(L)=100*J                                                     INP02190
      GO TO 43                                                           INP02200
   47 IV26(L)=100*J                                                      INP02210
      GO TO 43                                                           INP02220
   60 IGEN(L)=100*J                                                      INP02230
   43 CONTINUE                                                           INP02240
   42 CONTINUE                                                           INP02250
   50 CONTINUE                                                           INP02260
C                                                                        INP02270
C     ASSIGN INITIAL FAILURE TIMES TO COMMUNICATIONS VEHICLES AND        INP02280
C     EQUIPMENT                                                          INP02290
C                                                                        INP02300
      CALL INFAIL(5760.,8300000.,0.,11520.,21600.,1,IGENFL,54)           INP02310
      CALL INFAIL(5760.,8300000.,0.,11520.,21600.,1,IG50FL,140)          INP02320
      CALL INFAIL(5760.,8300000.,0.,11520.,21600.,1,IT7FL,56)            INP02330
      CALL INFAIL(5760.,8300000.,0.,11520.,21600.,1,IG26FL,21)           INP02340
      CALL INFAIL(200.,10000.,0.,400.,750.,10000,IM102,22)               INP02350
      CALL INFAIL(200.,10000.,0.,400.,750.,10000,IM103,32)               INP02360
      CALL  INFAIL(200.,10000.,0.,400.,750.,10000,IMCC6,17)
      CALL  INFAIL(200.,10000.,0.,400.,750.,10000,IV26,21)
      CALL  INFAIL(200.,10000.,0.,400.,750.,10000,IGEN,54)
C
C
      RETURN
      END


      SUBROUTINE ASSIGN
C
C
C     THIS SUBROUTINE ASSIGNS RADIOS AND MULTIPLEX EQUIPMENT TO
C     VEHICLES AND SYSTEMS
C
C
C     ASSIGN RADIO AND MULTIPLEX EQUIPMENT
C
C
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),
     1IDUM1(30),IGEN(54),LOCHQ(22)
      COMMON/C4/IG50FL(140),IT7FL(56),IG26FL(21),IGENFL(54),ISITFL(30)
      COMMON/C6/IX
      DIMENSION ISITE(2)
C
C     ASSIGN AN/GRC-50'S TO AN/MRC-102'S
C
      K=0
      DO 200 I=1,22
      DO 200 J=1,2
      K=K+1
  200 IGRC50(K)=(100+I)*100000
C
C     ASSIGN AN/GRC-50'S TO AN/MRC-103'S
C
      DO 201 I=1,32
      DO 201 J=1,3
      K=K+1
  201 IGRC50(K)=(200+I)*100000
C
C     ASSIGN AN/TCC-7'S TO AN/MRC-102'S
C
      DO 202 I=1,22
      KK=I
  202 ITCC7(I)=(100+I)*100000
C
C     ASSIGN AN/TCC-7'S TO AN/MCC-6'S
```

```
C                                                                       ASSC0400
      DO 203 I=1,17                                                     ASSC0410
      DO 203 J=1,2                                                      ASSC0420
      KK=KK+1                                                           ASSC0430
  203 ITCC7(KK)=(300+I)*100000                                          ASSC0440
C                                                                       ASSC0450
C     ASSIGN AN/GRC-26 RADIOS TO AN/GRC-26 VEHICLES                     ASSC0460
C                                                                       ASSC0470
      DO 204 I=1,21                                                     ASSC0480
  204 IGRC26(I)=(400+I)*100000                                          ASSC0490
C                                                                       ASSC0500
C                                                                       ASSC0510
C*************************************************************          ASSC0520
C                                                                       ASSC0530
C                                                                       ASSC0540
C                                                                       ASSC0550
C     ASSIGN MULTIPLEX EQUIPMENT TO CABLE SYSTEMS                       ASSC0560
C                                                                       ASSC0570
      DO 100 I=1,10                                                     ASSC0580
      IF(ICBSYS(I).EQ.0) GO TO 100                                      ASSC0590
C     DETERMINE FROM AND TO SITES OF SYSTEM                             ASSC0600
      IFROM=(ICBSYS(I)-(ICBSYS(I)/100000)*100000)/1000                  ASSC0610
      ITO=(ICBSYS(I)-(ICBSYS(I)/1000)*1000)/10                          ASSC0620
      NSTM=ICBSYS(I)/100000                                             ASSC0630
C     DO FOR FROM AND TO SITES                                          ASSC0640
      DO 101 J=1,2                                                      ASSC0650
C     DO FOR EACH MULTIPLEX IN MCC-6                                    ASSC0660
      DO 102 K=23,56                                                    ASSC0670
C     IS TCC-7 IN USE?                                                  ASSC0680
      IF((ITCC7(K)-(ITCC7(K)/100000)*100000)/100.NE.0) GO TO 102        ASSC0690
      NUMVEH=(K-23)/2+1                                                 ASSC0700
C     FIND SITE WHERE UNUSED TCC-7 IS LOCATED                           ASSC0710
      NSITE=(IMCC6(NUMVEH)-(IMCC6(NUMVEH)/10000)*10000)/100             ASSC0720
C     IF UNUSED RADIO IS AT FROM OR TO SITE ASSIGN IT TO SYSTEM         ASSC0730
      IF(J.EQ.2) GO TO 103                                              ASSC0740
      IF(NSITE.NE.IFROM) GO TO 102                                      ASSC0750
      ITCC7(K)=ITCC7(K)+ITO*100+NSTM*10000+1                            ASSC0760
      GO TO 101                                                         ASSC0770
  103 IF(NSITE.NE.ITO) GO TO 102                                        ASSC0780
      ITCC7(K)=ITCC7(K)+IFROM*100+NSTM*10000+1                          ASSC0790
      GO TO 101                                                         ASSC0800
  102 CONTINUE                                                          ASSC0810
C     SEARCH FOR TCC-7 IN MRC-102                                       ASSC0820
      DO 104 L=1,22                                                     ASSC0830
C     IS TCC-7 IN USE?                                                  ASSC0840
      IF((ITCC7(L)-(ITCC7(L)/10000)*10000)/10.NE.0)GO TO 104            ASSC0850
C     FIND SITE WHERE UNUSED TCC-7 IS LOCATED                           ASSC0860
      NSITE=(IM102(L)-(IM102(L)/10000)*10000)/100                       ASSC0870
C     IF RADIO IS AT FROM OR TO SITE ASSIGN IT TO SYSTEM                ASSC0870
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      IF(J.EQ.2) GO TO 107
      IF(NSITE.NE.IFROM) GO TO 104
      ITCC7(L)=ITCC7(L)+ITO*100+NSTM*10000+1
      GO TO 101
  107 IF(NSITE.NE.ITO) GO TO 104
      ITCC7(L)=ITCC7(L)+IFROM*100+NSTM*10000+1
      GO TO 1C1
  104 CONTINLE
C
C     WRITE ERROR MESSAGE IF SPARE TCC-7 CANNOT RE LOCATED
C
      IF(J.EQ.1) WRITE(6,105)IFRCM
      IF(J.EQ.2) WRITE(6,105)ITO
  105 FORMAT(/' INSUFFICIENT AN/TCC-7''S AT SITE',I3/)
C
  101 CONTINUE
  10C CONTINLE
C
C*************************************************************
C
C     DETERMINE WHICH HEADQUARTERS RACIO SITES ARE SUPPORTING
C
      DO 300 I=1,30
      IF(LOCSIT(I).EQ.0) GO TO 300
C     CHECK EACH HEADQUARTERS
      DO 301 J=1,22
C     FIND DISTANCE FROM SITE TO HEADQUARTERS
      DISTSQ=((LOCSIT(I)/1000-LOCHQ(J)/1000)**2)+(((LOCSIT(I)-(LOCSIT(I)
     1/1000)*10CC)-(LOCHQ(J)-(LOCHQ(J)/1000)*1000))**2)
      DIST=SQRT(DISTSQ)
C     IS HEADQUARTERS CHECKED CORPS MAIN, ALT, CR CORPS ARTY HO?
      IF(J.GE.4) GO TO 302
C     CHECK DISTANCE BETWEEN SITE AND HEADQUARTERS
      IF(DIST.LE.10.) GO TC 303
      GO TO 301
  302 IF(DIST.LE.5.) GO TO 303
  301 CONTINUE
C     ASSIGN SITES TO HEADQUARTERS
      LOCSIT(I)=LOCSIT(I)+99000000
      GO TO 300
  303 LOCSIT(I)=LOCSIT(I)+J*1000000
  300 CONTINLE
C
C*************************************************************
C
C     ASSIGN EQUIPMENT TC RADIC RELAY SYSTEMS
C
C     IFLAG1 - 1 = CANNOT FIND UNUSED TCC-7 IN MCC-6 FOR SITE
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C                2 = FOUND 1 SPARE TCC-7 IN MCC-6 FOR SITE "FROM"       ASSC1360
C                3 = FOUND 1 SPARE TCC-7 IN MCC-6 FOR SITE "TO"         ASSC1370
C     IFLAG2 -  0 = SITE IS A TERMINAL                                  ASSC1380
C                1 = SITE IS A RELAY                                    ASSC1390
C     IFLAG3 -  0 = GRC50 IN MRC-102 CHECKED FOR USE AS TERMINAL        ASSC1400
C                1 = GRC50 IN MRC-102 CHECKED FOR USE AS RELAY          ASSC1410
C                                                                       ASSC1420
C     DO FOR EACH RADIO RELAY SYSTEM                                    ASSC1430
      DO 400 I=1,50                                                     ASSC1440
      IF(IRRSYS(I).EQ.0)GO TO 400                                       ASSC1450
C     DETERMINE FROM AND TO SITES                                       ASSC1460
      ISITE(1)=(IRRSYS(I)-(IRRSYS(I)/100000)*100000)/1000               ASSC1470
      ISITE(2)=(IRRSYS(I)-(IRRSYS(I)/1000)*1000)/10                     ASSC1480
      NSTM=IRRSYS(I)/100000                                             ASSC1490
C     DO FOR FROM AND TO SITES                                          ASSC1500
      DO 401 J=1,2                                                      ASSC1510
      IFLAG2=0                                                          ASSC1520
C     IS THIS A RELAY SITE?                                             ASSC1530
      IF(LOCSIT(ISITE(J))/1000000.NE.99)GO TO 420                       ASSC1540
      IFLAG2=1                                                          ASSC1550
      GO TO 407                                                         ASSC1560
C     IS SITE SUPPORTING CORPS MAIN, ALT, OR ARTY HQ?                   ASSC1570
  420 IF(LOCSIT(ISITE(J))/1000000.GE.4)GO TO 415                        ASSC1580
C                                                                       ASSC1590
C     SEARCH FOR SPARE TCC-7 IN MCC-6                                   ASSC1600
      DO 404 K=23,56                                                    ASSC1610
C     IS TCC-7 USED                                                     ASSC1620
      IF((ITCC7(K)-(ITCC7(K)/100000)*100000)/100.NE.0)GO TO 404         ASSC1630
      NUMVEH=(K-23)/2+1                                                 ASSC1640
      NSITE=(IMCC6(NUMVEH)-(IMCC6(NUMVEH)/10000)*10000)/100             ASSC1650
C     CHECK FROM OR TO SITE AS APPROPRIATE                              ASSC1660
      IF(J.EQ.2)GO TO 405                                               ASSC1670
C     IS SITE OF SPARE TCC-7 THE SITE WE ARE LOOKING FOR?               ASSC1680
      IF(NSITE.NE.ISITE(1))GO TO 404                                    ASSC1690
      KK=K                                                              ASSC1700
      GO TO 407                                                         ASSC1710
  405 IF(NSITE.NE.ISITE(2))GO TO 404                                    ASSC1720
      KK=K                                                              ASSC1730
      GO TO 407                                                         ASSC1740
  404 CONTINUE                                                          ASSC1750
      GO TO 415                                                         ASSC1760
C                                                                       ASSC1770
C     SEARCH MRC-103'S FOR SPARE GRC-50'S                               ASSC1780
C                                                                       ASSC1790
  407 IFLAG1=1                                                          ASSC1800
      DO 408 L=45,140                                                   ASSC1810
C     IS GRC-50 IN USE?                                                 ASSC1820
      IF((IGRC50(L)-(IGRC50(L)/100000)*100000)/100.NE.0)GO TO 408       ASSC1830
      NUMVEH=(L-45)/3+1                                                 ASSC1840
      NSITE=(IM103(NUMVEH)-(IM103(NUMVEH)/10000)*10000)/100             ASS01850
C     CHECK FROM OR TO SITES AS APPROPRAITE                             ASS01860
      IF(J.EQ.2)GO TO 409                                               ASSC1870
      IF(NSITE.NE.ISITE(1))GC TO 408                                    ASS01880
      IF(IFLAG1.EQ.2)GO TO 411                                          ASSC1890
      IFLAG1=2                                                          ASS019C0
      LL=L                                                              ASS01910
C     IS NEXT SEQUENCE RADIO IN SAME VEHICLE?                           ASSC1920
  411 IF(NUMVEH.NE.(L-44)/3+1)GO TO 408                                 ASSC1930
      IF(IFLAG2.EQ.0)ITCC7(KK)=ITCC7(KK)+ISITE(2)*100+NSTM*10000+2      ASS01940
      IGRC50(L)=IGRC50(L)+ISITE(2)*100+NSTM*10000+2                     ASS01950
      GO TO 401                                                         ASS01960
  409 IF(NSITE.NE.ISITE(2))GC TO 408                                    ASS01970
      IF(IFLAG1.EQ.3)GO TO 412                                          ASSC1980
      IFLAG1=3                                                          ASSC1990
      LL=L                                                              ASSC20C0
  412 IF(NUMVEH.NE.(L-44)/3+1)GO TO 408                                 ASS02010
      IF(IFLAG2.EQ.0)ITCC7(KK)=ITCC7(KK)+ISITE(1)*100+NSTM*10000+2      ASS02020
      IGRC50(L)=IGRC50(L)+ISITE(1)*100+NSTM*10000+2                     ASS02030
      GO TO 401                                                         ASS02040
  408 CONTINLE                                                          ASS02050
C                                                                       ASS02060
      GO TO (415,413,414),IFLAG1                                        ASS02070
C     WAS ABLE TO FIND MRC-103 WITH ONE SPARE RADIO                     ASS02080
  413 IF(IFLAG2.EQ.0)ITCC7(KK)=ITCC7(KK)+ISITE(2)*100+NSTM*10000+2      ASSC2090
      IGRC50(LL)=IGRC50(LL)+ISITE(2)*100+NSTM*10000+2                   ASS02100
      GO TO 4C1                                                         ASS02110
  414 IF(IFLAG2.EQ.0)ITCC7(KK)=ITCC7(KK)+ISITE(1)*100+NSTM*10000+2      ASS02120
      IGRC50(LL)=IGRC50(LL)+ISITE(1)*100+NSTM*10000+2                   ASS02130
      GO TO 4C1                                                         ASS02140
C                                                                       ASS02150
C     SEARCH FOR MRC-102 WITH SPARE EQUIPMENT                           ASS0216C
  415 DO 416 M=1,22                                                     ASS02170
      IFLAG3=C                                                          ASS0218C
      MM=(2*M)-1                                                        ASS02190
      IF(IFLAG2.EQ.1)GO TO 421                                          ASS02200
C     IS TCC-7 USED                                                     ASS02210
      IF((ITCC7(M)-(ITCC7(M)/100000)*100000)/100.NE.0)GO TO 416         ASS02220
C     IS GRC-50 USED                                                    ASS02230
  421 IF((IGRC5C(MM)-(IGRC50(MM)/100000)*100000)/100.NE.0)GO TO 422     ASSC2240
      NSITE=(IM102(M)-(IM102(M)/10000)*10000)/100                       ASS02250
C     ASSIGN TCC-7 AND/OR GRC-50 TO SYSTEMS                             ASS0226C
      IF(J.EQ.2)GO TO 417                                               ASS02270
      IF(NSITE.NE.ISITE(1))GC TO 416                                    ASS0228C
      IF(IFLAG2.EQ.0)ITCC7(M)=ITCC7(M)+ISITE(2)*100+NSTM*10000+2        ASS02290
      IGRC50(MM)=IGRC50(MM)+ISITE(2)*100+NSTM*10000+2                   ASS023C0
      GO TO 4C1                                                         ASS02310
  417 IF(NSITE.NE.ISITE(2))GO TO 416
      IF(IFLAG2.EQ.0)ITCC7(M)=ITCC7(M)+ISITE(1)*100+NSTM*10000+2
      IGRC50(MM)=IGRC50(MM)+ISITE(1)*100+NSTM*10000+2
      GO TO 401
C     CHECK FOR SECOND SPARE GRC50 IN MRC-102 IF NECESSARY FOR RELAY
  422 IF(IFLAG2.EQ.0)GO TO 416
      IF(IFLAG3.EQ.1)GO TO 416
      IFLAG3=1
      MM=MM+1
      GO TO 421
  416 CONTINUE
C
C     WRITE ERROR MESSAGE IF NECESSARY
      IF(J.EQ.1)WRITE(6,418)ISITE(1)
      IF(J.EQ.2)WRITE(6,418)ISITE(2)
  418 FORMAT(/' INSUFFICIENT EQUIPMENT FOR RADIO RELAY SYSTEM AT SITE',
     1I3/)
C
  401 CONTINUE
  400 CONTINUE
C
C
C***********************************************************************
C
C     ASSIGN AN/GRC-26'S TO H-F SYSTEMS
C
      DO 500 I=1,20
      IF(IHFSYS(I).EQ.0)GO TO 500
C     DETERMINE FROM AND TO SITES
      IFROM=(IHFSYS(I)-(IHFSYS(I)/100000)*100000)/1000
      ITO=(IHFSYS(I)-(IHFSYS(I)/1000)*1000)/10
      NSTM=IHFSYS(I)/100000
C     DO FOR FROM AND TO SITES
      DO 501 J=1,2
C     DO FOR EACH AN/GRC-26
      DO 502 K=1,21
C     IS AN/GRC-26 IN USE?
      IF((IGRC26(K)-(IGRC26(K)/100000)*100000)/100.NE.0)GO TO 502
C     DETERMINE SITE WHERE AN/GRC-26 IS LOCATED
      NSITE=(IV25(K)-(IV25(K)/10000)*10000)/100
C     IF UNUSED RADIO IS AT TO OR FROM SITE ASSIGN IT TO THE SYSTEM
      IF(J.EQ.2)GO TO 503
      IF(NSITE.NE.IFROM)GO TO 502
      IGRC26(K)=IGRC25(K)+ITO*100+NSTM*10000+3
      GO TO 501
  503 IF(NSITE.NE.ITO)GO TO 502
      IGRC26(K)=IGRC26(K)+IFROM*100+NSTM*10000+3
      GO TO 501
```

```
 502 CONTINUE                                                           ASS02800
C                                                                       ASS02810
C     WRITE ERROR MESSAGE SINCE UNUSED AN/GRC-26 CANNOT BE FOUND        ASS02820
C                                                                       ASS02830
      IF(J.EQ.1)WRITE(6,505)IFROM                                       ASS02840
      IF(J.EQ.2)WRITE(6,505)ITO                                         ASS02850
 505  FORMAT(/' INSUFFICIENT AN/GRC26''S AT SITE',I3/)                  ASS02860
C                                                                       ASS02870
 501  CONTINUE                                                          ASS02880
 500  CONTINUE                                                          ASS02890
C                                                                       ASS02900
C     ASSIGN INITIAL SITE ATTACK TIMES                                  ASS02910
      DO 600 IK=1,30                                                    ASS02920
      ITYPE=LOCSIT(IK)/1000000                                          ASS02930
      IF(ITYPE)600,600,606                                              ASS02940
 606  CALL RANDU(IX,IY,YFL)                                             ASS02950
      IX=IY                                                             ASS02960
      IF(ITYPE-3)601,601,602                                            ASS02970
 601  ISITFL(IK)=YFL*115200.                                            ASS02980
      GO TO 600                                                         ASS02990
 602  IF(ITYPE-99)604,605,604                                           ASS03000
 605  ISITFL(IK)=YFL*28800.                                             ASS03010
      GO TO 600                                                         ASS03020
 604  ISITFL(IK)=YFL*86400.                                             ASS03030
 600  CONTINUE                                                          ASS03040
C                                                                       ASS03050
      RETURN                                                            ASS03060
C                                                                       ASS03070
      END                                                               ASS03080

      SUBROUTINE INFAIL(FMEAN,VAR,TRNCB,TRNCT,T,MULT,IARRAY,NUMBER)     INF00010
C                                                                       INF00020
C     THIS SUBROUTINE ASSIGNS INITIAL FAILURE TIMES TO EQUIPMENT BASED  INF00030
C     ON THE EQUILIBRIUM DISTRIBUTION OF THE TRUNCATED NORMAL PROBABILI-INF00040
C     ITY DISTRIBUTION                                                  INF00050
C                                                                       INF00060
C     IARRAY = ARRAY CONTAINING FAILURE TIMES FOR EQUIPMENT BEING       INF00070
C                INITIALIZED                                            INF00080
C     NUMBER = NUMBER OF ELEMENTS IN ARRAY                              INF00090
C     T      = TIME AT WHICH RENEWAL PROCESS IS ASSUMED TO HAVE REACHED INF00100
C                  IT'S EQUILIBRIUM DISTRIBUTION                        INF00110
C     FMEAN  = MEAN OF NORMAL (TRUNCATED) LIFE DISTRIBUTION DENSITY     INF00120
C     VAR    = VARIANCE OF NORMAL (TRUNCATED) LIFE DISTRIBUTION DENSITY INF00130
C     TRNCB  = BOTTOM TRUNCATION VALUE OF LIFE DISTRIBUTION DENSITY     INF00140
C     TRNCT  = TOP TRUNCATION VALUE OF LIFE DISTRIBUTION DENSITY        INF00150
C                                                                       INF00160
      COMMON/C6/IX                                                      INF00170
      DIMENSION IARRAY(1)                                               INFCC180
C                                                                       INFCC190
      DO 1 KK=1,NUMBER                                                  INFCC200
C     ZERO RUNNING SUM                                                  INFCC210
      RS=0.                                                             INFCC220
      S=SQRT(VAR)                                                       INFCC230
C     TAKE SAMPLE FROM NORMAL DISTRIBUTION                              INFCC240
   50 CALL GAUSS(IX,S,FMEAN,SAMP)                                       INFCC250
C     CHECK TO SEE IF SAMPLE LIES WITHIN TRUNCATION LIMITS              INFCC260
      IF(SAMP .LT. TRNCB) GO TO 50                                      INFCC270
      IF(SAMP.GT.TRNCT)GO TO 50                                         INFCC280
C     ADD SAMPLE TO RUNNING SUM AND CHECK AGAINST T                     INFCC290
      RS=RS+SAMP                                                        INFCC300
      IF(RS.LT.T)GO TO 50                                               INFCC310
C     CALCULATE TIME TO FAILURE MEASURED FROM T                         INFCC320
      TFAIL=RS-T                                                        INFCC330
      IFAIL=TFAIL                                                       INFCC340
    1 IARRAY(KK)=IARRAY(KK)+MULT*IFAIL                                  INFCC350
C                                                                       INFCC360
      RETURN                                                            INFCC370
      END                                                               INFCC380


      SUBROUTINE TABLE(NUMSIT)                                          TABCC010
C                                                                       TABCC020
C     THIS SUBROUTINE PRODUCES A TABLE OF EQUIPMENT AT SITES WITH STATUSTABCC030
C     AND IDENTIFIES SYSTEMS USED                                       TABCC040
C                                                                       TABCC050
C                                                                       TABCC060
C     NUM1-NUM5 = SUBSCRIPTS IN ARRAYS FOR ALPHANUMERIC PRINTOUT        TABCC070
C     IFLAG1 = INDICATOR THAT VEHICLE PRINTOUT IS TO BE MADE            TABCC080
C     IFLAG2 = INDICATOR THAT SYSTEMS PRINTOUT IS TO BE MADE            TABCC090
C     IFLAG3 = INDICATOR THAT DEADLINED EQUIPMENT IS TO BE PRINTED      TABCC100
C                                                                       TABCC110
      DIMENSION JSYS(3)                                                 TABCC120
      DOUBLE PRECISION VEHID,EQUIP                                      TABCC130
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      TABCC140
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICRSYS(10),TABCC150
     1IDUM1(30),IGEN(54),LOCHQ(22)                                      TABCC160
      COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)            TABCC170
      COMMON/C3/IREAD,IWRITE                                            TABCC180
C                                                                       TABCC190
      IOUT=6                                                            TABCC200
C     DETERMINE NUMBER OF SITES TO USE                                  TABCC210
      IBOT=NUMSIT                                                       TABCC220
      ITOP=NUMSIT                                                       TABCC230
      IF(NUMSIT)150,150,160                                             TABCC240
  150 IBOT=1                                                            TABCC250
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      ITOP=30                                                           TAB00260
      IF(IWRITE.EQ.1)IOUT=8                                             TAB00270
C                                                                       TAB00280
  160 WRITE(IOUT,500)                                                   TAB00290
  500 FORMAT(/'1',15X,'*',6X,'VEHICLES',6X,'*',10X,'SYSTEMS',10X,'*',   TAB00300
     1/16X,'*',20X,'*',27X,'*'/' SITE  LOCATION *  TYPE     NUM  OPER', TAB00310
     2' * FROM  TO  NUM  TYPE  OPER * DEADLINED EQUIP')                 TAB00320
C                                                                       TAB00330
      DO 1 NSITE=IBOT,ITOP                                              TAB00340
C     IS SITE USED?                                                     TAB00350
      IF(LOCSIT(NSITE).EQ.0)GO TO 1                                     TAB00360
C     PRINT SITE LOCATION AND SUPPORTED HEADQUARTERS ON TABLE           TAB00370
      WRITE(IOUT,200)                                                   TAB00380
  200 FORMAT('**********************************************************TAB00390
     1*************************')                                       TAB00400
      ICOORD=LOCSIT(NSITE)-(LOCSIT(NSITE)/1000000)*1000000              TAB00410
      ID=(LOCSIT(NSITE)/1000000)*3-2                                    TAB00420
      IF(ID.EQ.99*3-2)ID=67                                             TAB00430
      ID1=ID+1                                                          TAB00440
      ID2=ID+2                                                          TAB00450
      WRITE(IOUT,201)NSITE,ICOORD,HQ(ID),HQ(ID1),HQ(ID2)                TAB00460
  201 FORMAT(I4,I10,'  *',20X,'*',27X,'*'/1X,3A4,'   *',20X,'*',27X,'*' TAB00470
     1)                                                                 TAB00480
C                                                                       TAB00490
C     CHECK FOR ANY MRC-103'S                                           TAB00500
C                                                                       TAB00510
      DO 2 J=1,32                                                       TAB00520
C     IS MRC-103 AT SITE?                                               TAB00530
      IF((IM103(J)-(IM103(J)/10000)*10000)/100.NE.NSITE)GO TO 2         TAB00540
      NUM1=1                                                            TAB00550
      NUM2=1                                                            TAB00560
C     IS EQUIP DEADLINED?                                               TAB00570
      IF((IM103(J)-(IM103(J)/100)*100)/10.EQ.1)NUM2=2                   TAB00580
C     NUMBER OF FIRST AND LAST RADIOS                                   TAB00590
      IFIRST=44+J*3-2                                                   TAB00600
      JFIRST=IFIRST                                                     TAB00610
      ILAST=IFIRST+2                                                    TAB00620
      IFLAG1=1                                                          TAB00630
  100 IF(IFIRST.GT.ILAST)GO TO 101                                      TAB00640
C     CHECK EACH RADIO FOR SYSTEM                                       TAB00650
      DO 3 K=IFIRST,ILAST                                               TAB00660
      IFIRST=K+1                                                        TAB00670
      ISYS=(IGRC50(K)-(IGRC50(K)/100000)*100000)/100                    TAB00680
C     IS SYSTEM ON RADIO?                                               TAB00690
      IF(ISYS.EQ.0)GO TO 3                                              TAB00700
      NSYS=ISYS/100                                                     TAB00710
      IDSITE=ISYS-(ISYS/100)*100                                        TAB00720
C     PRINT SYSTEM INFO                                                 TAB00730
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      IFLAG2=1                                                          TABC0740
      NUM3=2                                                            TABC0750
      NUM4=1                                                            TABC0760
C     CHECK TO SEE IF SYSTEM IS OPERATIONAL                             TABC0770
      CALL SYSOP(IRRSYS,NSYS,NSITE,IDSITE,NUM4,50,IFROM,ITO,II)         TABC0780
      GO TO 6                                                           TABC0790
    3 CONTINUE                                                          TABC0800
  101 IFLAG2=0                                                          TABC0810
C                                                                       TABC0820
    6 IF(JFIRST.GT.ILAST)GO TO 102                                      TABC0830
C     CHECK EACH RADIO FOR OPERATIVENESS                                TABC0840
      DO 7 L=JFIRST,ILAST                                               TABC0850
C     IS RADIO OPERATIVE                                                TABC0860
      IF((IGRC50(L)-(IGRC50(L)/100)*100)/10.EQ.0)GO TO 7                TABC0870
      NUM5=1                                                            TABC0880
      IFLAG3=1                                                          TABC0890
      JFIRST=JFIRST+1                                                   TABC0900
      GO TO 8                                                           TABC0910
    7 CONTINUE                                                          TABC0920
  102 IFLAG3=0                                                          TABC0930
    8 IF(IFLAG1+IFLAG2+IFLAG3.EQ.0)GO TO 2                              TABC0940
      CALL TABLE1(IFLAG1,IFLAG2,IFLAG3,VEHID,STATUS,SYSTYP,EQUIP,       TABC0950
     1NUM1,NUM2,NUM3,NUM4,NUM5,IFROM,ITO,NSYS,J,ICUT)                   TABC0960
      GO TO 100                                                         TABC0970
C                                                                       TABC0980
    2 CONTINUE                                                          TABC0990
C                                                                       TABC1000
C     CHECK FOR ANY MCC-6'S                                             TABC1010
C     SIMILAR LOGIC TO MRC-103'S, THEREFORE SAME COMMENTS HOLD          TABC1020
C                                                                       TABC1030
      DO 602 J=1,17                                                     TABC1040
      IF((IMCC6(J)-(IMCC6(J)/10000)*10000)/100.NE.NSITE)GO TO 602       TABC1050
      NUM1=2                                                            TABC1060
      NUM2=1                                                            TABC1070
      IF((IMCC6(J)-(IMCC6(J)/100)*100)/10.EQ.1)NUM2=2                   TABC1080
      IFIRST=22+J*2-1                                                   TABC1090
      JFIRST=IFIRST                                                     TABC1100
      ILAST=IFIRST+1                                                    TABC1110
      IFLAG1=1                                                          TABC1120
  700 IF(IFIRST.GT.ILAST)GO TO 701                                      TABC1130
      DO 603 K=IFIRST,ILAST                                             TABC1140
      IFIRST=K+1                                                        TABC1150
      ISYS=(ITCC7(K)-(ITCC7(K)/100000)*100000)/100                      TABC1160
      IF(ISYS.EQ.0)GO TO 603                                            TABC1170
      NSYS=ISYS/100                                                     TABC1180
      IDSITE=ISYS-(ISYS/100)*100                                        TABC1190
      IFLAG2=1                                                          TABC1200
      NUM3=ITCC7(K)-(ITCC7(K)/10)*10                                    TABC1210
      NUM4=1                                                            TAB01220
      GO TO (750,751),NUM3                                              TAB01230
  750 CALL SYSOP(ICBSYS,NSYS,NSITE,IDSITE,NUM4,10,IFROM,ITO,II)         TAB01240
      GO TO 606                                                         TAB01250
  751 CALL SYSOP(IRRSYS,NSYS,NSITE,IDSITE,NUM4,50,IFROM,ITO,II)         TAB01260
      GO TO 606                                                         TAB01270
  603 CONTINUE                                                          TAB01280
  701 IFLAG2=0                                                          TAB01290
  606 IF(JFIRST.GT.ILAST)GO TO 702                                      TAB01300
      DO 607 L=JFIRST,ILAST                                             TAB01310
      IF((ITCC7(L)-(ITCC7(L)/100)*100)/10.EQ.0)GO TO 607                TAB01320
      NUM5=2                                                            TAB01330
      IFLAG3=1                                                          TAB01340
      JFIRST=JFIRST+1                                                   TAB01350
      GO TO 608                                                         TAB01360
  607 CONTINUE                                                          TAB01370
  702 IFLAG3=0                                                          TAB01380
  608 IF(IFLAG1+IFLAG2+IFLAG3.EQ.0)GO TO 602                            TAB01390
      CALL TABLE1(IFLAG1,IFLAG2,IFLAG3,VEHID,STATUS,SYSTYP,EQUIP,NUM1,  TAB01400
     1NUM2,NUM3,NUM4,NUM5,IFROM,ITO,NSYS,J,IOUT)                        TAB01410
      GO TO 700                                                         TAB01420
  602 CONTINUE                                                          TAB01430
C                                                                       TAB01440
C     CHECK FOR MRC-102'S                                               TAB01450
      DO 802 J=1,22                                                     TAB01460
C     IS MRC-102 AT SITE?                                               TAB01470
      IF((IM102(J)-(IM102(J)/10000)*10000)/100.NE.NSITE)GO TO 802       TAB01480
C     INITIALIZE ARRAY USED TO PREVENT DUPLICATE LISTING OF SYSTEMS     TAB01490
      DO 899 II=1,3                                                     TAB01500
  899 JSYS(II)=0                                                        TAB01510
      IISYS=1                                                           TAB01520
      NUM1=3                                                            TAB01530
      ICHK1=0                                                           TAB01540
      ICHK2=0                                                           TAB01550
      NUM2=1                                                            TAB01560
C     IS VEHICLE OPERATIVE?                                             TAB01570
      IF((IM102(J)-(IM102(J)/100)*100)/10.EQ.1)NUM2=2                   TAB01580
C     NUMBER FIRST AND LAST RADIOS                                      TAB01590
      IFIRST=J*2-1                                                      TAB01600
      JFIRST=IFIRST                                                     TAB01610
      ILAST=IFIRST+1                                                    TAB01620
      IFLAG1=1                                                          TAB01630
  900 IF(IFIRST.GT.ILAST)GO TO 901                                      TAB01640
C     CHECK EACH RADIO FOR SYSTEM                                       TAB01650
      DO 803 K=IFIRST,ILAST                                             TAB01660
      IFIRST=IFIRST+1                                                   TAB01670
      ISYS=(IGRC50(K)-(IGRC50(K)/100000)*100000)/100                    TAB01680
      IF(ISYS.EQ.0)GO TO 803                                            TAB01690
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C     FOUND SYSTEM - ENTER IT IN ARRAY PREVENTING DUPLICATE LISTING
      ICHECK=ISYS*10+IGRC50(K)-(IGRC50(K)/10)*10
      JSYS(IISYS)=ICHECK
      IISYS=IISYS+1
      NSYS=ISYS/100
      IDSITE=ISYS-(ISYS/100)*100
      IFLAG2=1
      NUM3=IGRC50(K)-(IGRC50(K)/10)*10
      NUM4=1
      CALL SYSOP(IRRSYS,NSYS,NSITE,IDSITE,NUM4,50,IFROM,ITO,II)
      GO TO 806
  803 CONTINUE
C     CHECK TCC-7 FOR SYSTEM
  901 IF(ICHK1.EQ.1)GO TO 950
      ICHK1=1
      ISYS=(ITCC7(J)-(ITCC7(J)/100000)*100000)/100
      IF(ISYS.EQ.0)GO TO 950
C     CHECK TO SEE IF SYSTEM HAS ALREADY BEEN LISTED
      ICHECK=ISYS*10+ITCC7(J)-(ITCC7(J)/10)*10
      DO 898 JJ=1,IISYS
      IF(JSYS(JJ).EQ.ICHECK)GO TO 950
  898 CONTINUE
      NSYS=ISYS/100
      IDSITE=ISYS-(ISYS/100)*100
      IFLAG2=1
      NUM3=ITCC7(J)-(ITCC7(J)/10)*10
      NUM4=1
      GO TO(952,953),NUM3
  952 CALL SYSOP(ICBSYS,NSYS,NSITE,IDSITE,NUM4,10,IFROM,ITO,II)
      GO TO 806
  953 CALL SYSOP(IRRSYS,NSYS,NSITE,IDSITE,NUM4,50,IFROM,ITO,II)
      GO TO 806
  950 IFLAG2=0
C     CHECK FOR OPERATIVENESS OF GRC-50'S
  806 IF(JFIRST.GT.ILAST)GO TO 902
      DO 907 L=JFIRST,ILAST
      IF((IGRC50(L)-(IGRC50(L)/100)*100)/10.EQ.0)GO TO 907
      NUM5=1
      IFLAG3=1
      JFIRST=JFIRST+1
      GO TO 956
  907 CONTINUE
C     CHECK FOR OPERATIVENESS OF TCC-7'S
  902 IF(ICHK2.EQ.1)GO TO 954
      ICHK2=1
      IF((ITCC7(J)-(ITCC7(J)/100)*100)/10.EQ.0)GO TO 954
      NUM5=2
      IFLAG3=1
      GO TO 956                                                         TAB02180
  954 IFLAG3=0                                                          TAB02190
  956 IF(IFLAG1+IFLAG2+IFLAG3.EQ.0)GO TO 802                            TAB02200
      CALL TABLE1(IFLAG1,IFLAG2,IFLAG3,VEHID,STATUS,SYSTYP,EQUIP,NUM1,  TAB02210
     1NUM2,NUM3,NUM4,NUM5,IFROM,ITO,NSYS,J,IOUT)                        TAB02220
      GO TO 900                                                         TAB02230
  802 CONTINUE                                                          TAB02240
C                                                                       TAB02250
C     CHECK FOR ANY GRC-26'S                                            TAB02260
      DO 302 J=1,21                                                     TAB02270
C     IS GRC-26 AT SITE?                                                TAB02280
      IF((IV26(J)-(IV26(J)/10000)*10000)/100.NE.NSITE)GO TO 302         TAB02290
      IFLAG1=1                                                          TAB02300
      NUM1=4                                                            TAB02310
      NUM2=1                                                            TAB02320
C     IS VEHICLE OPERABLE                                               TAB02330
      IF((IV26(J)-(IV26(J)/100)*100)/10.EQ.1)NUM2=2                     TAB02340
C     CHECK FOR SYSTEM ON RADIO                                         TAB02350
      ISYS=(IGRC26(J)-(IGRC26(J)/100000)*100000)/100                    TAB02360
      IF(ISYS.EQ.0)GO TO 303                                            TAB02370
      NSYS=ISYS/100                                                     TAB02380
      IDSITE=ISYS-(ISYS/100)*100                                        TAB02390
      IFLAG2=1                                                          TAB02400
      NUM3=3                                                            TAB02410
      NUM4=1                                                            TAB02420
      CALL SYSOP(IHFSYS,NSYS,NSITE,IDSITE,NUM4,20,IFROM,ITO,II)         TAB02430
      GO TO 306                                                         TAB02440
  303 IFLAG2=0                                                          TAB02450
C     CHECK RADIO FOR OPERATIVENESS                                     TAB02460
  306 IF((IGRC26(J)-(IGRC26(J)/100)*100)/10.EQ.0)GO TO 307              TAB02470
      NUM5=3                                                            TAB02480
      IFLAG3=1                                                          TAB02490
      GO TO 308                                                         TAB02500
  307 IFLAG3=0                                                          TAB02510
  308 IF(IFLAG1+IFLAG2+IFLAG3.EQ.0)GO TO 302                            TAB02520
      CALL TABLE1(IFLAG1,IFLAG2,IFLAG3,VEHID,STATUS,SYSTYP,EQUIP,NUM1,  TAB02530
     1NUM2,NUM3,NUM4,NUM5,IFROM,ITO,NSYS,J,IOUT)                        TAB02540
  302 CONTINUE                                                          TAB02550
C                                                                       TAB02560
    1 CONTINUE                                                          TAB02570
C                                                                       TAB02580
      RETURN                                                            TAB02590
C                                                                       TAB02600
      END                                                               TAB02610


      SUBROUTINE TABLE1(IFLAG1,IFLAG2,IFLAG3,VEHID,STATUS,SYSTYP,EQUIP, TABC0010
     1NUM1,NUM2,NUM3,NUM4,NUM5,IFROM,ITO,NSYS,J,IOUT)                   TABC0020
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C                                                                       TABC0030
C     THIS SUBROUTINE PRINTS INDIVIDUAL LINES OF TABLE GENERATED IN     TABC0040
C     SUBROUTINE TABLE                                                  TABC0050
C                                                                       TABC0060
      DOUBLE PRECISION VEHID(1),EQUIP(1)                                TABC0070
      DIMENSION STATUS(1),SYSTYP(1)                                     TABC0080
C                                                                       TABC0090
C     PRINT LINE ON TABLE                                               TABC0100
  300 IF(IFLAG1+IFLAG2+IFLAG3.NE.3)GO TO 301                            TABC0110
      WRITE(IOUT,201)VEHID(NUM1),J,STATUS(NUM2),IFROM,ITO,NSYS,SYSTYP(NUTABC0120
     1M3),STATUS(NUM4),EQUIP(NUM5)                                      TABC0130
  201 FORMAT(16X,'* ',A8,I3,3X,A4,' *',I4,I5,I4,3X,A4,3X,A4,'* ',A8)    TABC0140
      GO TO 400                                                         TABC0150
  301 IF(IFLAG1+IFLAG2.NE.2)GO TO 302                                   TABC0160
      WRITE(IOUT,201)VEHID(NUM1),J,STATUS(NUM2),IFROM,ITO,NSYS,SYSTYP(NUTABC0170
     1M3),STATUS(NUM4)                                                  TABC0180
      GO TO 400                                                         TABC0190
  302 IF(IFLAG1+IFLAG3.NE.2) GO TO 303                                  TABC0200
      WRITE(IOUT,203)VEHID(NUM1),J,STATUS(NUM2),EQUIP(NUM5)             TABC0210
  203 FORMAT(16X,'* ',A8,I3,3X,A4,' *',27X,'* ',A8)                     TABC0220
      GO TO 400                                                         TABC0230
  303 IF(IFLAG2+IFLAG3.NE.2)GO TO 304                                   TABC0240
      WRITE(IOUT,204)IFROM,ITO,NSYS,SYSTYP(NUM3),STATUS(NUM4),EQUIP(NUM5TABC0250
     1)                                                                 TABC0260
  204 FORMAT(16X,'*',20X,'*',I4,I5,I4,3X,A4,3X,A4,'* ',A8)              TABC0270
      GO TO 400                                                         TABC0280
  304 IF(IFLAG1.NE.1)GO TO 305                                          TABC0290
      WRITE(IOUT,205)VEHID(NUM1),J,STATUS(NUM2)                         TABC0300
  205 FORMAT(16X,'* ',A8,I3,3X,A4,' *',27X,'*')                         TABC0310
      GO TO 400                                                         TABC0320
  305 IF(IFLAG2.NE.1)GO TO 306                                          TABC0330
      WRITE(IOUT,206)IFROM,ITO,NSYS,SYSTYP(NUM3),STATUS(NUM4)           TABC0340
  206 FORMAT(16X,'*',20X,'*',I4,I5,I4,3X,A4,3X,A4,'*')                  TABC0350
      GO TO 400                                                         TABC0360
  306 WRITE(IOUT,207)EQUIP(NUM5)                                        TABC0370
  207 FORMAT(16X,'*',20X,'*',27X,'* ',A8)                               TABC0380
  400 IFLAG1=0                                                          TABC0390
C                                                                       TABC0400
C                                                                       TABC0410
      RETURN                                                            TABC0420
C                                                                       TABC0430
      END                                                               TABC0440

      SUBROUTINE SYSOP (ISYS,NSYS,NSITE,IDSITE,NUM4,ITOP,IFROM,ITO,II)  SYS00010
C                                                                       SYS00020
C     THIS SUBROUTINE FINDS SYSTEM IN ARRAY AND DETERMINES OPERATIVENESSSYS00030
C                                                                       SYS00040
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      DIMENSION ISYS(1)                                                 SYS00050
C                                                                       SYS00060
C     FIND SYSTEM IN ARRAY                                              SYS00070
      DO 15 II=1,ITOP                                                   SYS00080
      IF(ISYS(II)/100000.NE.NSYS)GO TO 15                               SYS00090
C     DETERMINE FROM AND TO SITES OF SYSTEM                             SYS00100
      IFROM=(ISYS(II)-(ISYS(II)/100000)*100000)/1000                    SYS00110
      ITO=(ISYS(II)-(ISYS(II)/1000)*1000)/10                            SYS00120
C     COMPARE FROM AND TO SITES WITH SITES FOR SYSTEM OF INTEREST       SYS00130
      IF(IFROM.EQ.NSITE)GO TO 16                                        SYS00140
      IF(IFROM.NE.IDSITE)GO TO 15                                       SYS00150
      IF(ITO.NE.NSITE)GO TO 15                                          SYS00160
      GO TO 17                                                          SYS00170
   16 IF(ITO.NE.IDSITE)GO TO 15                                         SYS00180
   17 IF(ISYS(II)-(ISYS(II)/10)*10.EQ.1)NUM4=2                          SYS00190
      RETURN                                                            SYS00200
   15 CONTINUE                                                          SYS00210
      NUM4=3                                                            SYS00220
      RETURN                                                            SYS00230
C                                                                       SYS00240
      END                                                               SYS00250


      SUBROUTINE GENTAB(IPRINT)                                         GEN00010
C                                                                       GEN00020
C     THIS SUBROUTINE PRINTS A TABLE GIVING THE NUMBER AND STATUS OF    GEN00030
C     GENERATORS LOCATED AT EACH SITE                                   GEN00040
C                                                                       GEN00050
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      GEN00060
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),GEN00070
     1IDUM1(30),IGEN(54),LOCHQ(22)                                      GEN00080
      COMMON/C3/IREAD,IWRITE                                            GEN00090
C                                                                       GEN00100
      IOUT=6                                                            GEN00110
      IF(IPRINT)5,5,6                                                   GEN00120
    5 IF(IWRITE.EQ.1)IOUT=8                                             GEN00130
C                                                                       GEN00140
    6 WRITE(IOUT,3)                                                     GEN00150
    3 FORMAT(1H1//16X,'GENERATORS'//' SITE      OPERATIONAL  DEADLINED',GEN00160
     13X,'TOTAL')                                                       GEN00170
C                                                                       GEN00180
      DO 1 NSITE=1,30                                                   GEN00190
C     IS SITE USED?                                                     GEN00200
      IF(LOCSIT(NSITE).EQ.0)GO TO 1                                     GEN00210
C     CHECK GENERATOR ARRAY FOR GENERATORS AT SITE                      GEN00220
C     INITIALIZE COUNTERS                                               GEN00230
      IOP=0                                                             GEN00240
      IDL=0                                                             GEN00250
      DO 2 I=1,54                                                       GENC0260
      IF((IGEN(I)-(IGEN(I)/10000)*10000)/100.NE.NSITE)GO TO 2           GENC0270
C     INCREMENT NUMBER OF OPERATIONAL GENERATORS                        GENC0280
      IF((IGEN(I)-(IGEN(I)/100)*100)/10.EQ.0)IOP=IOP+1                  GENC0290
C     INCREMENT NUMBER OF DEADLINED GENERATORS                          GENC0300
      IF((IGEN(I)-(IGEN(I)/100)*100)/10.EQ.1)IDL=IDL+1                  GENC0310
    2 CONTINUE                                                          GENC0320
      ITOT=IDL+IOP                                                      GENC0330
C     WRITE LINE IN TABLE                                               GENC0340
      WRITE(IOUT,4)NSITE,IOP,IDL,ITOT                                   GENC0350
    4 FORMAT(I3,3I12)                                                   GENC0360
    1 CONTINUE                                                          GENC0370
C                                                                       GENC0380
      RETURN                                                            GENC0390
C                                                                       GENC0400
      END                                                               GENC0410


      SUBROUTINE SEARCH                                                 SEAC0010
C                                                                       SEAC0020
C     THIS SUBROUTINE PLACES EVENTS IN FUTURE EVENTS CALENDER BY ONE    SEAC0030
C     HOUR SEARCHES UNTIL 55 EVENTS ARE IN CALENDAR                     SEAC0040
C                                                                       SEAC0050
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      SEAC0060
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICRSYS(10  SEAC0070
     2),IDUM1(30),IGEN(54),LOCHQ(22)                                    SEAC0080
      COMMON/C4/IG50FL(140),IT7FL(56),IG26FL(21),IGENFL(54),ISITFL(30)  SEAC0090
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR                    SEAC0100
C                                                                       SEAC0110
C     DETERMINE LAST SCHEDULED EVENT IN CALENDER                        SEAC0120
      DO 3 I=1,100                                                      SEAC0130
      IF(IEVCAL(I).NE.0)GO TO 3                                         SEAC0140
      J=I                                                               SEAC0150
      GO TO 4                                                           SEAC0160
    3 CONTINUE                                                          SEAC0170
C                                                                       SEAC0180
C     CHECK AN/GRC-50'S FOR SCHEDULED FAILURES AND INITIALIZE SEARCH    SEAC0190
C     TIME                                                              SEAC0200
    4 ITIME1=0                                                          SEAC0210
    1 ITIME1=ITIME1+60                                                  SEAC0220
      DO 2 I=1,140                                                      SEAC0230
      IF(IG50FL(I).GT.ITIME1)GO TO 2                                    SEAC0240
C     IS RADIO IN USE                                                   SEAC0250
      IF((IGRC50(I)-(IGRC50(I)/100000)*100000)/100.EQ.0)GO TO 2         SEAC0260
C     IS RADIO DEADLINED                                                SEAC0270
      IF((IGRC50(I)-(IGRC50(I)/100)*100)/10.EQ.1)GO TO 2                SEAC0280
      JEVCAL(J)=IG50FL(I)+ITIME                                         SEAC0290
      IEVCAL(J)=11000+I                                                 SEAC0300
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C     SET TIME OF FAILURE IN EQUIPMENT ARRAY EQUAL TO HIGH NUMBER       SEA00310
      IG50FL(I)=99999999                                                SEA00320
      J=J+1                                                             SEA00330
    2 CONTINUE                                                          SEA00340
C                                                                       SEA00350
C     CHECK AN/TCC-7'S FOR SCHEDULED FAILURES                           SEA00360
      DO 5 I=1,56                                                       SEA00370
      IF(IT7FL(I).GT.ITIME1)GO TO 5                                     SEA00380
      IF((ITCC7(I)-(ITCC7(I)/100000)*100000)/100.EQ.0)GO TO 5           SEA00390
      IF((ITCC7(I)-(ITCC7(I)/100)*100)/10.EQ.1)GO TO 5                  SEA00400
      JEVCAL(J)=IT7FL(I)+ITIME                                          SEA00410
      IEVCAL(J)=12000+I                                                 SEA00420
      IT7FL(I)=99999999                                                 SEA00430
      J=J+1                                                             SEA00440
    5 CONTINUE                                                          SEA00450
C                                                                       SEA00460
C     CHECK AN/GRC26'S FOR SCHEDULED FAILURES                           SEA00470
      DO 6 I=1,21                                                       SEA00480
      IF(IG26FL(I).GT.ITIME1)GO TO 6                                    SEA00490
      IF((IGRC26(I)-(IGRC26(I)/100000)*100000)/100.EQ.0)GO TO 6         SEA00500
      IF((IGRC26(I)-(IGRC26(I)/100)*100)/10.EQ.1)GO TO 6                SEA00510
      JEVCAL(J)=IG26FL(I)+ITIME                                         SEA00520
      IEVCAL(J)=13000+I                                                 SEA00530
      IG26FL(I)=99999999                                                SEA00540
      J=J+1                                                             SEA00550
    6 CONTINUE                                                          SEA00560
C                                                                       SEA00570
C     CHECK GENERATORS FOR SCHEDULED FAILURES                           SEA00580
      DO 7 I=1,54                                                       SEA00590
      IF(IGENFL(I).GT.ITIME1)GO TO 7                                    SEA00600
      IF((IGEN(I)-(IGEN(I)/100000)*100000)/100.EQ.0)GO TO 7             SEA00610
      IF((IGEN(I)-(IGEN(I)/100)*100)/10.EQ.1)GO TO 7                    SEA00620
      JEVCAL(J)=IGENFL(I)+ITIME                                         SEA00630
      IEVCAL(J)=14000+I                                                 SEA00640
      IGENFL(I)=99999999                                                SEA00650
      J=J+1                                                             SEA00660
    7 CONTINUE                                                          SEA00670
C                                                                       SEA00680
C     CHECK FOR SITE ATTACKS                                            SEA00690
      DO 8 I=1,30                                                       SEA00700
C     IS SITE IN USE                                                    SEA00710
      IF(LOCSIT(I))8,8,9                                                SEA00720
    9 IF(ISITFL(I).GT.ITIME1)GO TO 8                                    SEA00730
      JEVCAL(J)=ISITFL(I)+ITIME                                         SEA00740
      IEVCAL(J)=70000+I                                                 SEA00750
      ISITFL(I)=99999999                                                SEA00760
      J=J+1                                                             SEA00770
    8 CONTINUE                                                          SEA00780
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C                                                                       SEAC0790
C     ARE 55 EVENTS IN FUTURE EVENTS CALENDER?                          SEAC0800
      IF(IEVCAL(55).EQ.0)GO TO 1                                        SEAC0810
C                                                                       SEAC0820
C     ORDER EVENTS IN TABLE BY TIME                                     SEAC0830
      CALL ORDERT                                                       SEAC0840
C                                                                       SEAC0850
      RETURN                                                            SEAC0860
      END                                                               SEAC0870


      SUBROUTINE UPDATE (ISUB)                                          UPD00010
C                                                                       UPD00020
C                                                                       UPD00030
C     THIS SUBROUTINE UPDATES THE SCHEDULED FAILURE TIMES OF EQUIPMENT  UPD00040
C     IN USE AS SIMULATION TIME PROGRESSES (SUBTRACTS TIME FROM         UPD00050
C     SCHEDULED FAILURES FOR EQUIPMENT IN OPERATION BUT NOT IN FUTURE   UPD00060
C     EVENTS TABLE)                                                     UPD00070
C                                                                       UPD00080
C                                                                       UPD00090
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      UPD00100
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),           UPD00110
     2ICBSYS(10),IDUM1(30),IGEN(54),LOCHQ(22)                           UPD00120
      COMMON/C4/IG50FL(140),IT7FL(56),IG26FL(21),IGENFL(54),ISITFL(30)  UPD00130
C                                                                       UPD00140
C     UPDATE GRC-50 RADIOS                                              UPD00150
      DO 1 I=1,140                                                      UPD00160
C     IF GRC-50'S ARE IN USE SUBTRACT TIME FROM SCHEDULED FAILURE TIMES UPD00170
      IF((IGRC50(I)-(IGRC50(I)/100000)*100000)/100)1,1,2                UPD00180
    2 IG50FL(I)=IG50FL(I)-ISUB                                          UPD00190
    1 CONTINUE                                                          UPD00200
C                                                                       UPD00210
C     UPDATE TCC-7 MULTIPLEXERS                                         UPD00220
      DO 3 I=1,56                                                       UPD00230
      IF((ITCC7(I)-(ITCC7(I)/100000)*100000)/100)3,3,4                  UPD00240
    4 IT7FL(I)=IT7FL(I)-ISUB                                            UPD00250
    3 CONTINUE                                                          UPD00260
C                                                                       UPD00270
C     UPDATE GRC-26 RADIOS                                              UPD00280
      DO 5 I=1,21                                                       UPD00290
      IF((IGRC26(I)-(IGRC26(I)/100000)*100000)/100)5,5,6                UPD00300
    6 IG26FL(I)=IG26FL(I)-ISUB                                          UPD00310
    5 CONTINUE                                                          UPD00320
C                                                                       UPD00330
C     UPDATE GENERATORS                                                 UPD00340
      DO 7 I=1,54                                                       UPD00350
      IF((IGEN(I)-(IGEN(I)/10000)*10000)/100)7,7,8                      UPD00360
    8 IGENFL(I)=IGENFL(I)-ISUB                                          UPD00370
    7 CONTINUE                                                          UPD00380
C                                                                       UPD00390
C     UPDATE SITE ATTACKS                                               UPD00400
      DO 9 I=1,30                                                       UPD00410
      IF(LOCSIT(I))9,9,10                                               UPD00420
   10 ISITFL(I)=ISITFL(I)-ISUB                                          UPD00430
    9 CONTINUE                                                          UPD00440
C                                                                       UPD00450
      RETURN                                                            UPD00460
      END                                                               UPD00470


      SUBROUTINE SWITCH                                                 SWI00010
C                                                                       SWI00020
C     THIS SUBROUTINE DETERMINES THE APPROPRIATE SUBROUTINE TO          SWI00030
C     PROCESS THE CURRENT EVENT                                         SWI00040
C                                                                       SWI00050
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR                    SWI00060
C                                                                       SWI00070
C     IF ACTION IS INITIATED BY THE SIMULATION GO TO THE APPROPRIATE    SWI00080
C     SUBROUTINE                                                        SWI00090
      IDUM=IEVCUR/10000                                                 SWI00100
      GO TO(1,2,3,4,5,6,7),IDUM                                         SWI00110
C                                                                       SWI00120
C     IF ACTION IS INITIATED BY THE PLAYER GO TO THE APPROPRIATE        SWI00130
C     SUBROUTINE                                                        SWI00140
      IDUM1=IEVCUR/100                                                  SWI00150
      NUMB=IEVCUR-IDUM1*100                                             SWI00160
      GO TO(10,11,12,13,14,15),IDUM1                                    SWI00170
      IF(IEVCUR.NE.999)RETURN                                           SWI00180
C                                                                       SWI00190
      WRITE(6,200)                                                      SWI00200
  200 FORMAT(///' GAME HAS BEEN TERMINATED'///)                         SWI00210
      CALL EXIT                                                         SWI00220
    1 CALL EQFAIL                                                       SWI00230
      GO TO 100                                                         SWI00240
    2 CALL EQREP                                                        SWI00250
      GO TO 100                                                         SWI00260
    3 NUMB=(IEVCUR-(IEVCUR/10000)*10000)/1000+3                         SWI00270
      CALL EQINST(NUMB)                                                 SWI00280
      GO TO 100                                                         SWI00290
    4 NUMB=(IEVCUR-(IEVCUR/10000)*10000)/1000+5                         SWI00300
      CALL VEHMOV(NUMB)                                                 SWI00310
      GO TO 100                                                         SWI00320
    5 NUMB=(IEVCUR-(IEVCUR/10000)*10000)/1000                           SWI00330
      CALL VEHBKD(NUMB)                                                 SWI00340
      GO TO 100                                                         SWI00350
    6 NUMB=(IEVCUR-(IEVCUR/10000)*10000)/1000                           SWI00360
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      CALL VEHREP(NUMB)                                                 SWI00370
      GO TO 100                                                         SWI00380
    7 CALL SITACK                                                       SWI00390
      GO TO 100                                                         SWI00400
   10 IF(NUMB-50)20,21,21                                               SWI00410
   21 CALL GENTAB(1)                                                    SWI00420
      GO TO 100                                                         SWI00430
   20 CALL TABLE(NUMB)                                                  SWI00440
      GO TO 100                                                         SWI00450
   11 CALL EQREM(NUMB)                                                  SWI00460
      GO TO 100                                                         SWI00470
   12 CALL EQINST(NUMB)                                                 SWI00480
      GO TO 100                                                         SWI00490
   13 CALL SYSREM(NUMB)                                                 SWI00500
      GO TO 100                                                         SWI00510
   14 CALL SYINST(NUMB)                                                 SWI00520
      GO TO 100                                                         SWI00530
   15 CALL VEHMOV(NUMB)                                                 SWI00540
  100 RETURN                                                            SWI00550
C                                                                       SWI00560
      END                                                               SWI00570


      SUBROUTINE EQFAIL                                                 EQF00010
C                                                                       EQF00020
C     THIS SUBROUTINE PRINTS MESSAGES DESCRIBING EQUIPMENT FAILURES,    EQF00030
C     ASSIGNS AND PRINTS ESTIMATE OF REPAIR TIME, ASSIGNS ACTUAL REPAIR EQF00040
C     TIME, AND SCHEDULES REPAIR EVENT                                  EQF00050
C                                                                       EQF00060
      DOUBLE PRECISION VEHID,EQUIP                                      EQF00070
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMC06(17),IV26(21),      EQF00080
     1IGRC50(140),ITC07(56),IGRC26(21),IPRSYS(50),IHFSYS(20),ICBSYS(10),EQF00090
     2IDUM1(30),IGEN(54),LOCHG(22)                                      EQF00100
      COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(49)            EQF00110
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR                    EQF00120
      COMMON/C6/IX                                                      EQF00130
C                                                                       EQF00140
C     DETERMINE UNIT NUMBER AND FAILURE TYPE                            EQF00150
      IUNIT=IEVCUR-(IEVCUR/1000)*1000                                   EQF00160
      IEQTYP=(IEVCUR-(IEVCUR/10000)*10000)/1000                         EQF00170
C     CHOOSE FAILURE FORMAT TYPE                                        EQF00180
      GO TO (11,12,13,14),IEQTYP                                        EQF00190
C                                                                       EQF00200
C     GRC-50 FAILURE                                                    EQF00210
C     DETERMINE VEHICLE TYPE, NUMBER, SYSTEM NUMBER, AND TO AND FROM LOCEQF00220
   11 IVEHTP=IGRC50(IUNIT)/10000000                                     EQF00230
      IVEHNO=(IGRC50(IUNIT)-(IGRC50(IUNIT)/10000000)*10000000)/100000   EQF00240
      ISYSNO=(IGRC50(IUNIT)-(IGRC50(IUNIT)/100000)*100000)/10000        EQF00250
      ITO=(IGRC50(IUNIT)-(IGRC50(IUNIT)/10000)*10000)/100
      IF(IVEHTP-1)1,1,2
    1 IFROM=(IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100
      NUM1=3
      GO TO 3
    2 IFROM=(IM103(IVEHNO)-(IM103(IVEHNO)/10000)*10000)/100
      NUM1=1
C     CHANGE FLAGS ON EQUIPMENT AND SYSTEM UNITS FOR DEADLINED EQUIP
    3 IGRC50(IUNIT)=IGRC50(IUNIT)+10
      IF(ITO)800,800,801
C     LOCATE SYSTEM
  801 CALL SYSOP(IRRSYS,ISYSNO,IFROM,ITO,NUM4,50,K,KK,I)
      IF(IRRSYS(I)-(IRRSYS(I)/10)*10)700,700,8
  700 IRRSYS(I)=IRRSYS(I)+1
C     DETERMINE ARRAY SUBSCRIPTS FOR PRINTOUT
    8 IF(LOCSIT(IFROM)/1000000-22)300,300,301
  301 NUM2=3*23-2
      GO TO 302
  300 NUM2=3*(LOCSIT(IFROM)/1000000)-2
  302 IF(ITO-22)303,304,304
  304 NUM3=3*23-2
      GO TO 305
  303 NUM3=3*ITO-2
C     WRITE PLAYER MESSAGE
  305 WRITE(6,9)VEHID(NUM1),IVEHNO,HQ(NUM2),HQ(NUM2+1),HQ(NUM2+2),IFROM,
     1ISYSNO,HQ(NUM2),HQ(NUM2+1),HQ(NUM2+2),IFROM,HQ(NUM3),HQ(NUM3+1),
     2HQ(NUM3+2),ITO
    9 FORMAT(/18H EQUIPMENT FAILURE/5X,18HAN/GRC-50 RADIO IN,A9,
     17H NUMBER,I3,12H LOCATED AT ,3A4,6H (SITE,I3,1H)/5X,44HFAILED. RAD
     2IO WAS OPERATING ON SYSTEM NUMBER,I3,6H FROM ,3A4,6H (SITE,I3,1H)/
     35X,3HTO ,3A4,6H (SITE,I3,1H))
      GO TO 101
  800 WRITE(6,802)VEHID(NUM1),IVEHNO
  802 FORMAT(/19H AN/GRC-50 RADIO IN,A9,6HNUMBER,I3,18H HAS BEEN DAMAGED
     1.)
C     SCHEDULE REPAIR EVENT
  101 CALL GAUSS(IX,150.,300.,REP)
      IREP=REP
      IF(IREP)101,200,200
  200 IEVCAL(100)=21000+IUNIT
      GO TO 100
C
C     TCC-7 FAILURE
C     DETERMINE VEHICLE TYPE, NUMBER, SYSTEM NUMBER,AND TO AND FROM LOC
   12 IVEHTP=ITCC7(IUNIT)/10000000
      IVEHNO=(ITCC7(IUNIT)-(ITCC7(IUNIT)/10000000)*10000000)/100000
      ISYSNO=(ITCC7(IUNIT)-(ITCC7(IUNIT)/100000)*100000)/10000
      ITO=(ITCC7(IUNIT)-(ITCC7(IUNIT)/10000)*10000)/100
      IF(IVEHTP-1)15,15,16
   15 IFROM=(IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100
      NUM1=3
      GO TO 17
   16 IFROM=(IMCC6(IVEHNO)-(IMCC6(IVEHNO)/10000)*10000)/100
      NUM1=2
   17 ISYSTP=ITCC7(IUNIT)-(ITCC7(IUNIT)/10)*10
C
C     CHANGE FLAGS ON EQUIPMENT AND SYSTEM UNITS TO REFLECT DEADLINED EQ
      ITCC7(IUNIT)=ITCC7(IUNIT)+10
      IF(ITO)803,803,804
C     LOCATE SYSTEM IN ARRAY
  804 IF(ISYSTP-1)18,18,19
   18 CALL SYSOP(ICBSYS,ISYSNO,IFROM,ITO,NUM4,10,K,KK,I)
      IF(ICBSYS(I)-(ICBSYS(I)/10)*10)20,20,24
   20 ICBSYS(I)=ICBSYS(I)+1
      GO TO 24
   19 CALL SYSOP(IRRSYS,ISYSNO,IFROM,ITO,NUM4,50,K,KK,I)
      IF(IRRSYS(I)-(IRRSYS(I)/10)*10)22,22,24
   22 IRRSYS(I)=IRRSYS(I)+1
   24 IF(LOCSIT(IFROM)/1000000-22)400,400,401
  401 NUM2=3*23-2
      GO TO 402
  400 NUM2=3*(LOCSIT(IFROM)/1000000)-2
  402 IF(ITO-22)403,404,404
  404 NUM3=3*23-2
      GO TO 405
  403 NUM3=3*ITO-2
  405 WRITE(6,26)VEHID(NUM1),IVEHNO,HQ(NUM2),HQ(NUM2+1),HQ(NUM2+2),
     1IFROM,SYSTYP(ISYSTP),ISYSNO,HQ(NUM2),HQ(NUM2+1),HQ(NUM2+2),IFROM,
     2HQ(NUM3),HQ(NUM3+1),HQ(NUM3+2),ITO
   26 FORMAT(/18H EQUIPMENT FAILURE/5X,21HAN/TCC-7 MULTIPLEX IN,A9,
     17H NUMBER,I3,12H LOCATED AT ,3A4,5H(SITE,I3,1H)/5X,
     235HFAILED. MULTIPLEX WAS OPERATING ON ,A4,13HSYSTEM NUMBER,I3,
     36H FROM ,3A4,6H (SITE,I3,1H)/5X,3HTO ,3A4,6H (SITE,I3,1H))
      GO TO 102
  803 WRITE(6,805)VEHID(NUM1),IVEHNO
  805 FORMAT(/22H AN/TCC-7 MULTIPLEX IN,A9,6HNUMBER,I3,
     118H HAS BEEN DAMAGED.)
C     SCHEDULE REPAIR EVENT
  102 CALL GAUSS(IX,150.,300.,REP)
      IREP=REP
      IF(IREP)102,201,201
  201 IEVCAL(100)=22000+IUNIT
      GO TO 100
C
C     GRC-26 RADIO FAILURE
   13 ISYSNO=(IGRC26(IUNIT)-(IGRC26(IUNIT)/100000)*100000)/10000
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      ITO=(IGRC26(IUNIT)-(IGRC26(IUNIT)/10000)*10000)/100               EQF01220
      IFROM=(IV26(IUNIT)-(IV26(IUNIT)/10000)*10000)/100                 EQF01230
C     CHANGE FLAGS ON EQUIPMENT AND SYSTEM UNITS TO REFLECT DEADLINED EQEQF01240
      IGRC26(IUNIT)=IGRC26(IUNIT)+10                                    EQF01250
C     LOCATE SYSTEM IN ARRAY                                            EQF01260
      IF(ITO)806,806,807                                                EQF01270
  807 CALL SYSOP(IHFSYS,ISYSNO,IFROM,ITO,NUM4,20,K,KK,I)                EQF01280
      IF(IHFSYS(I)-(IHFSYS(I)/10)*10)27,27,31                           EQF01290
   27 IHFSYS(I)=IHFSYS(I)+1                                             EQF01300
   31 IF(LOCSIT(IFROM)/1000000-22)500,500,501                           EQF01310
  501 NUM2=3*23-2                                                       EQF01320
      GO TO 502                                                         EQF01330
  500 NUM2=3*(LOCSIT(IFROM)/1000000)-2                                  EQF01340
  502 IF(ITO-22)503,504,504                                             EQF01350
  504 NUM3=3*23-2                                                       EQF01360
      GO TO 505                                                         EQF01370
  503 NUM3=3*ITO-2                                                      EQF01380
  505 WRITE(6,32)IUNIT,HQ(NUM2),HQ(NUM2+1),HQ(NUM2+2),IFROM,ISYSNO,     EQF01390
     1HQ(NUM2),HQ(NUM2+1),HQ(NUM2+2),IFROM,HQ(NUM3),HQ(NUM3+1),         EQF01400
     2HQ(NUM3+2),ITO                                                    EQF01410
   32 FORMAT(/18H EQUIPMENT FAILURE/5X,33HAN/GRC-26 RADIO IN VEHICLE NUMEQF01420
     1BER,I3,12H LOCATED AT ,3A4,6H (SITE,I3/1H)/5X,44HFAILED. RADIO WASEQF01430
     2 OPERATING ON SYSTEM NUMBER,I3,6H FROM ,3A4,6H (SIE,,I3,1H)/5X,   EQF01440
     33HTO ,3A4,6H (SITE,I3,1H))                                        EQF01450
C     SCHEDULE REPAIR EVENT                                             EQF01460
  103 CALL GAUSS(IX,150.,300.,REP)                                      EQF01470
      IREP=REP                                                          EQF01480
      IF(IREP)103,202,202                                               EQF01490
  202 IEVCAL(100)=23000+IUNIT                                           EQF01500
      GO TO 100                                                         EQF01510
C                                                                       EQF01520
C     GENERATOR FAILURE                                                 EQF01530
   14 IFROM=(IGEN(IUNIT)-(IGEN(IUNIT)/10000)*10000)/100                 EQF01540
      IF(LOCSIT(IFROM)/1000000-22)600,600,601                           EQF01550
  601 NUM2=3*23-2                                                       EQF01560
      GO TO 602                                                         EQF01570
  600 NUM2=3*(LOCSIT(IFROM)/1000000)-2                                  EQF01580
C     CHANGE FLAG ON GENERATOR TO FAILED                                EQF01590
  602 IGEN(IUNIT)=IGEN(IUNIT)+10                                        EQF01600
      WRITE(6,33)IUNIT,HQ(NUM2),HQ(NUM2+1),HQ(NUM2+2),IFROM             EQF01610
   33 FORMAT(/18H EQUIPMENT FAILURE/5X,16HGENERATOR NUMBER,I3,          EQF01620
     112H LOCATED AT ,3A4,6H (SITE,I3,9H) FAILED.)                      EQF01630
      GO TO 104                                                         EQF01640
  806 WRITE(6,808)VEHID(NUM1),IVEHNO                                    EQF01650
  808 FORMAT(/19H AN/GRC-26 RADIO IN,A9,6HNUMBER,I3,18H HAS BEEN DAMAGEDEQF01660
     1.)                                                                EQF01670
C                                                                       EQF01680
C     SCHEDULE REPAIR EVENT                                             EQF01690
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  104 CALL GAUSS(IX,150.,300.,REP)                                      EQFO1700
      IREP=REP                                                          EQFO1710
      IF(IREP)104,203,203                                               EQFO1720
  203 IEVCAL(100)=24000+IUNIT                                           EQFO1730
C                                                                       EQFO1740
C     DETERMINE ESTIMATED TIME OF REPAIR FOR THE PLAYER, SCHEDULE       EQFO1750
C     TIME OF REPAIR EVENT, ORDER EVENTS                                EQFO1760
  100 JEVCAL(100)=IREP+ITIME                                            EQFO1770
      CALL ORDERT                                                       EQFO1780
  205 CALL GAUSS(IX,50.,REP,EST)                                        EQFO1790
      IEST=EST                                                          EQFO1800
      IF(IEST)205,204,204                                               EQFO1810
C     PRINT PLAYER MESSAGE                                              EQFO1820
  204 IHOUR=0                                                           EQFO1830
  252 IF(IEST-60)250,251,251                                            EQFO1840
  251 IHOUR=IHOUR+1                                                     EQFO1850
      IEST=IEST-60                                                      EQFO1860
      GO TO 252                                                         EQFO1870
  250 WRITE (6,253)IHOUR,IEST                                           EQFO1880
  253 FORMAT(/5X,24HESTIMATED REPAIR TIME IS,I3,6H HOURS,I3,5H MIN.)    EQFO1890
C                                                                       EQFO1900
      RETURN                                                            EQFO1910
      END                                                               EQFO1920


      SUBROUTINE EQREP                                                  EQRO0010
C                                                                       EQRO0020
C     THIS SUBROUTINE PRINTS MESSAGES WHEN COMMUNICATIONS EQUIPMENT IS  EQRO0030
C     REPAIRED, RETURNS EQUIPMENT TO OPERATIONAL STATUS, SCHEDULES NEW  EQRO0040
C     EQUIPMENT FAILURE TIME, AND RETURNS SYSTEM TO OPERATION IF        EQRO0050
C     EQUIPMENT WAS ON A SYSTEM AND NO OTHER DEADLINED EQUIPMENT        EQRO0060
C     EXISTS ON THE SYSTEM                                              EQRO0070
C                                                                       EQRO0080
      DOUBLE PRECISION VEHID,EQUIP                                      EQRO0090
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      EQRO0100
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),EQRO0110
     2IDUM1(30),IGEN(54),LOCHQ(22)                                      EQRO0120
      COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)            EQRO0130
      COMMON/C4/IG50FL(140),IT7FL(56),IG26FL(21),IGENFL(54),ISITFL(30)  EQRO0140
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR                    EQRO0150
      COMMON/C6/IX                                                      EQRO0160
C                                                                       EQRO0170
C     DETERMINE UNIT NUMBER AND TYPE                                    EQRO0180
      IUNIT=IEVCUR-(IEVCUR/1000)*1000                                   EQRO0190
      IEQTYP=(IEVCUR-(IEVCUR/10000)*10000)/1000                         EQRO0200
      GO TO(1,2,3,4),IEQTYP                                             EQRO0210
C                                                                       EQRO0220
C     GRC-50                                                            EQRO0230
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C     DETERMINE RADIO SITE AND VEHICLE INFORMATION
    1 IVEHTP=IGRC50(IUNIT)/10000000
      IVEHNO=(IGRC50(IUNIT)-(IGRC50(IUNIT)/10000000)*10000000)/100000
      IF(IVEHTP-1)12,12,13
   12 IFROM=(IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100
      NUM1=3
      GO TO 14
   13 IFROM=(IM103(IVEHNO)-(IM103(IVEHNO)/10000)*10000)/100
      NUM1=1
C     DETERMINE ARRAY SUBSCRIPTS FOR PRINTCUT
   14 IF(LOCSIT(IFROM)/1000000-22)300,300,301
  301 NUM2=3*23-2
      GO TO 302
  300 NUM2=3*(LOCSIT(IFROM)/1000000)-2
C     WRITE PLAYER MESSAGE
  302 WRITE(6,303)VEHID(NUM1),IVEHNO,HQ(NUM2),HQ(NUM2+1),HQ(NUM2+2),
     1IFROM
  303 FORMAT(/17H EQUIPMENT REPAIR/5X,18HAN/GRC-50 RADIO IN,A9,
     17H NUMBER,I3,12H LOCATED AT ,3A4,6H (SITE,I3,1H)/5X,
     218HHAS BEEN REPAIRED.)
C     CHANGE FLAG ON RADIO
      IGRC50(IUNIT)=IGRC50(IUNIT)-10
C     SCHEDULE NEXT FAILURE TIME FOR RADIO
  985 CALL GAUSS(IX,2880.,5760.,FAIL)
      IF(FAIL)985,976,976
  976 IFAIL=FAIL
      IG50FL(IUNIT)=IFAIL+ITIME
C     IF RADIO IS CONNECTED TO A SYSTEM AND THE SYSTEM CAN NOW OPERATE -
C     CHANGE STATUS OF SYSTEM
      IF((IGRC50(IUNIT)-(IGRC50(IUNIT)/100000)*100000)/100)400,400,401
C     WILL SYSTEM OPERATE WHEN THIS SYSTEM IS REPAIRED
  401 ISYSNO=(IGRC50(IUNIT)-(IGRC50(IUNIT)/100000)*100000)/10000
      ITO=(IGRC50(IUNIT)-(IGRC50(IUNIT)/10000)*10000)/100
C     IF FUTURE EVENTS CALENDER CONTAINS EQUIPMENT COMPLETION EVENT ON
C     SAME SYSTEM - RETURN
      CALL CKEVNT(IFROM,ITC,2,ISYSNO,IRESLT)
      IF(IRESLT)700,700,400
  700 CALL OP50(IFROM,ITO,ISYSNO,IUNIT)
      GO TO 400
C
C     TCC-7
C     DETERMINE RADIO SITE AND VEHICLE INFORMATION
    2 IVEHTP=ITCC7(IUNIT)/10000000
      IVEHNO=(ITCC7(IUNIT)-(ITCC7(IUNIT)/10000000)*10000000)/100000
      IF(IVEHTP-1)512,512,513
  512 IFROM=(IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100
      NUM1=3
      GO TO 514
  513 IFROM=(IMCC6(IVEHNO)-(IMCC6(IVEHNO)/10000)*10000)/100                    FOR00720
      NUM1=2                                                                  FOR00730
C     DETERMINE ARRAY SUBSCRIPTS FOR PRINTOUT                                 FOR00740
  514 IF(LOCSIT(IFROM)/1000000-22)550,550,551                                 FOR00750
  551 NUM2=3*23-2                                                             FOR00760
      GO TO 552                                                               FOR00770
  550 NUM2=3*(LOCSIT(IFROM)/1000000)-2                                        FOR00780
C     DETERMINE TYPE OF SYSTEM                                                FOR00790
  552 ISYSTP=ITCC7(IUNIT)-(ITCC7(IUNIT)/10)*10                                FOR00800
C     WRITE PLAYER MESSAGE                                                    FOR00810
      WRITE(6,553)VEHID(NUM1),IVEHNO,HQ(NUM2),HQ(NUM2+1),HQ(NUM2+2),          FOR00820
     1IFROM                                                                   FOR00830
  553 FORMAT(/17H EQUIPMENT REPAIR/5X,21HAN/TCC-7 MULTIPLEX IN,A9,            FOR00840
     17H NUMBER,I3,12H LOCATED AT ,3A4,6H (SITE,I3,1H)/5X,                    FOR00850
     218HHAS BEEN REPAIRED.)                                                  FOR00860
C     CHANGE FLAG ON MULTIPLEX                                                FOR00870
      ITCC7(IUNIT)=ITCC7(IUNIT)-10                                            FOR00880
C     SCHEDULE NEXT FAILURE TIME FOR MULTIPLEX                                FOR00890
  977 CALL GAUSS(IX,2880.,5760.,FAIL)                                         FOR00900
      IF(FAIL)977,978,978                                                     FOR00910
  978 IFAIL=FAIL                                                              FOR00920
      IT7FL(IUNIT)=IFAIL+ITIME                                                FOR00930
C     IF MULTIPLEX IS CONNECTED TO A SYSTEM AND THE SYSTEM CAN NOW            FOR00940
C     OPERATE - CHANGE STATUS OF SYSTEM                                       FOR00950
      IF((ITCC7(IUNIT)-(ITCC7(IUNIT)/100000)*100000)/100)400,400,601          FOR00960
  601 ISYSNO=(ITCC7(IUNIT)-(ITCC7(IUNIT)/100000)*100000)/10000                FOR00970
      ITO=(ITCC7(IUNIT)-(ITCC7(IUNIT)/10000)*10000)/100                       FOR00980
C     IF FUTURE EVENTS CALENDER CONTAINS EQUIPMENT COMPLETION EVENT ON        FOR00990
C     SAME SYSTEM - RETURN                                                    FOR01000
      CALL CKEVNT(IFROM,ITO,ISYSTP,ISYSNO,IRESLT)                             FOR01010
      IF(IRESLT)701,701,400                                                   FOR01020
  701 CALL OP7(IFROM,ITO,ISYSNO,ISYSTP,IUNIT)                                 FOR01030
      GO TO 400                                                               FOR01040
C                                                                             FOR01050
C     GRC-26                                                                  FOR01060
C     DETERMINE RADIO SITE AND VEHICLE INFORMATION                            FOR01070
    3 IFROM=(IV26(IUNIT)-(IV26(IUNIT)/10000)*10000)/100                       FOR01080
      IF(LOCSIT(IFROM)/1000000-22)800,800,801                                 FOR01090
  801 NUM2=2*23-2                                                             FOR01100
      GO TO 802                                                               FOR01110
  800 NUM2=3*(LOCSIT(IFROM)/1000000)-2                                        FOR01120
C     WRITE PLAYER MESSAGE                                                    FOR01130
  802 WRITE(6,803)IUNIT,HQ(NUM2),HQ(NUM2+1),HQ(NUM2+2),IFROM                  FOR01140
  803 FORMAT(/17H EQUIPMENT REPAIR/5X,32HRADIO IN ANGRC-26 VEHICLE NUMBEFOR01150
     1R,I3,12H LOCATED AT ,3A4,6H(SITE,I3,1H)/5X,18HHAS BEEN REPAIRED.) FOR01160
C     CHANGE FLAG ON RADIO                                                    FOR01170
      IGRC26(IUNIT)=IGRC26(IUNIT)-10                                          FOR01180
C     SCHEDULE NEXT FAILURE TIME FOR RADIO                                    FOR01190
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  979 CALL GAUSS(IX,2880.,5760.,FAIL)                                    EQR01200
      IF(FAIL)979,980,980                                                EQR01210
  980 IFAIL=FAIL                                                         EQR01220
      IG26FL(IUNIT)=IFAIL+ITIME                                          EQR01230
C     IF RADIO IS CONNECTED TO A SYSTEM AND THE SYSTEM CAN NOW           EQR01240
C     OPERATE - CHANGE STATUS OF SYSTEM                                  EQR01250
      IF((IGRC26(IUNIT)-(IGRC26(IUNIT)/100000)*100000)/100)400,400,901   EQR01260
C     WILL SYSTEM OPERATE WHEN THIS RADIO IS REPAIRED?                   EQR01270
  901 ISYSNO=(IGRC26(IUNIT)-(IGRC26(IUNIT)/100000)*100000)/10000         EQR01280
      ITO=(IGRC26(IUNIT)-(IGRC26(IUNIT)/10000)*10000)/100                EQR01290
C     IF FUTURE EVENTS CALENDER CONTAINS EQUIPMENT COMPLETION EVENT ON   EQR01300
C     SAME SYSTEM - RETURN                                               EQR01310
      CALL CKEVNT(IFROM,ITO,3,ISYSNO,IRESLT)                             EQR01320
      IF(IRESLT)702,702,400                                              EQR01330
  702 CALL OP26(IFROM,ITO,ISYSNO)                                        EQR01340
      GO TO 400                                                          EQR01350
C                                                                        EQR01360
C     GENERATOR                                                          EQR01370
    4 IFROM=(IGEN(IUNIT)-(IGEN(IUNIT)/10000)*10000)/100                  EQR01380
C     DETERMINE ARRAY SUBSCRIPTS FOR PRINTOUT                            EQR01390
      IF(LOCSIT(IFROM)/1000000-22)950,950,951                            EQR01400
  951 NUM2=3*23-2                                                        EQR01410
      GO TO 952                                                          EQR01420
  950 NUM2=3*(LOCSIT(IFROM)/1000000)-2                                   EQR01430
C     WRITE PLAYER MESSAGE                                               EQR01440
  952 WRITE(6,953)IUNIT,HQ(NUM2),HQ(NUM2+1),HQ(NUM2+2),IFROM             EQR01450
  953 FORMAT(/17H EQUIPMENT REPAIR/5X,16HGENERATOR NUMBER,I3,            EQR01460
     112H LOCATED AT ,3A4,6H (SITE,I3,1H)/5X,18HHAS BEEN REPAIRED.)      EQR01470
C     CHANGE FLAG ON GENERATOR                                           EQR01480
      IGEN(IUNIT)=IGEN(IUNIT)-10                                         EQR01490
C     SCHEDULE NEXT FAILURE TIME FOR GENERATOR                           EQR01500
  981 CALL GAUSS(IX,2880.,5760.,FAIL)                                    EQR01510
      IF(FAIL)981,982,982                                                EQR01520
  982 IFAIL=FAIL                                                         EQR01530
      IGENFL(IUNIT)=IFAIL+ITIME                                          EQR01540
C                                                                        EQR01550
  400 RETURN                                                             EQR01560
      END                                                                EQR01570


      SUBROUTINE OP50(IFROM,ITO,ISYSNO,IUNIT)                            OP500010
C                                                                        OP500020
C     THIS SUBROUTINE DETERMINES IF OPERATIONAL AN/GRC-50 (IUNIT) WILL   OP500030
C     ENABLE THE NON-OPERATIONAL RR SYSTEM TO WORK                       OP500040
C                                                                        OP500050
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),       OP500060
     1IGRC50(140),ITCC7(56),IGRC25(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),OP500070
     2IDUM1(30),IGEN(54),LOCHQ(22)                                       OP500080
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C                                                                       OP500090
      J=ISYSNO*100+IFROM                                                OP500100
      DO 402 I=1,140                                                    OP500110
C     IS RADIO ON RR SYSTEM?                                            OP500120
      IF(IGRC50(I)-(IGRC50(I)/10)*10-2)402,403,402                      OP500130
C     IS SYSTEM AND SITE NUMBER CORRECT?                                OP500140
  403 IF((IGRC50(I)-(IGRC50(I)/100000)*100000)/100-J)402,404,402        OP500150
C     IS RADIO OPERATIONAL?                                             OP500160
  404 IF((IGRC50(I)-(IGRC50(I)/100)*100)/10)406,406,400                 OP500170
  402 CONTINUE                                                          OP500180
      GO TO 400                                                         OP500190
  406 IF(LOCSIT(ITO)/1000000-22)670,670,656                             OP500200
  670 DO 407 K=1,56                                                     OP500210
C     IS TCC-7 ON RR SYSTEM?                                            OP500220
      IF(ITCC7(K)-(ITCC7(K)/10)*10-2)407,408,407                        OP500230
C     IS SYSTEM AND SITE NUMBER CORRECT?                                OP500240
  408 IF((ITCC7(K)-(ITCC7(K)/100000)*100000)/100-J)407,409,407          OP500250
C     IS MULTIPLEX OPERATIONAL?                                         OP500260
  409 IF((ITCC7(K)-(ITCC7(K)/100)*100)/10)656,656,400                   OP500270
  407 CONTINUE                                                          OP500280
      GO TO 400                                                         OP500290
  656 IF(LOCSIT(IFROM)/1000000-22)655,655,410                           OP500300
  655 JJ=ISYSNO*100+ITO                                                 OP500310
      DO 650 KK=1,56                                                    OP500320
      IF(ITCC7(KK)-(ITCC7(KK)/10)*10-2)650,651,650                      OP500330
  651 IF((ITCC7(KK)-(ITCC7(KK)/100000)*100000)/100-JJ)650,652,650       OP500340
  652 IF((ITCC7(KK)-(ITCC7(KK)/100)*100)/10)410,410,400                 OP500350
  650 CONTINUE                                                          OP500360
      GO TO 400                                                         OP500370
C     CHANGE FLAG ON SYSTEM TO OPERATIONAL                              OP500380
  410 CALL SYSOP(IRRSYS,ISYSNO,IFROM,ITO,NUM4,50,K,KK,I)                OP500390
      IRRSYS(I)=IRRSYS(I)-1                                             OP500400
C     WRITE PLAYER MESSAGE                                              OP500410
      WRITE(6,411)ISYSNO,K,KK                                           OP500420
  411 FORMAT(/26H RADIO RELAY SYSTEM NUMBER,I2,10H FROM SITE,I3,        OP500430
     18H TO SITE,I3,18H IS NOW OPERATING.)                              OP500440
C                                                                       OP500450
  400 RETURN                                                            OP500460
      END                                                               OP500470

      SUBROUTINE OP7(IFROM,ITO,ISYSNO,ISYSTP,IUNIT)                     OP700010
C                                                                       OP700020
C     THIS SUBROUTINE DETERMINES IF OPERATIONAL AN/TCC-7 (IUNIT) WILL   OP700030
C     ENABLE THE NON-OPERATIONAL RR OR CBL SYSTEM TO WORK               OP700040
C                                                                       OP700050
      DOUBLE PRECISION VEHID,EQUIP                                      OP700060
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      OP700070
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),OP700080
     2IDUM1(30),IGEN(54),LOCHQ(22)                                     OP700090
C                                                                       OP700100
      COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)           OP700110
      J=ISYSNO*100+IFROM                                               OP700120
C     CHOOSE EITHER RR OR CBL SYSTEM                                   OP700130
      IF(ISYSTP-1)706,706,603                                          OP700140
C     RR SYSTEM                                                        OP700150
  603 DO 702 I=1,140                                                   OP700160
      IF(IGRC50(I)-(IGRC50(I)/10)*10-2)702,703,702                     OP700170
  703 IF((IGRC50(I)-(IGRC50(I)/100000)*100000)/100-J)702,704,702       OP700180
  704 IF((IGRC50(I)-(IGRC50(I)/100)*100)/10)756,756,400                OP700190
  702 CONTINUE                                                         OP700200
      GO TO 400                                                        OP700210
  756 JJ=ISYSNO*100+ITO                                                OP700220
      DO 850 IJ=1,140                                                  OP700230
      IF(IGRC50(IJ)-(IGRC50(IJ)/10)*10-2)850,758,850                   OP700240
  758 IF((IGRC50(IJ)-(IGRC50(IJ)/100000)*100000)/100-JJ)850,759,850    OP700250
  759 IF((IGRC50(IJ)-(IGRC50(IJ)/100)*100)/10)706,706,400              OP700260
  850 CONTINUE                                                         OP700270
      GO TO 400                                                        OP700280
C     CBL SYSTEM AND RR SYSTEM                                         OP700290
  706 IF(LOCSIT(ITO)/1000000-22)975,975,710                            OP700300
  975 DO 707 K=1,56                                                    OP700310
      IF(ITCC7(K)-(ITCC7(K)/10)*10-ISYSTP)707,708,707                  OP700320
  708 IF((ITCC7(K)-(ITCC7(K)/100000)*100000)/100-J)707,709,707         OP700330
  709 IF((ITCC7(K)-(ITCC7(K)/100)*100)/10)710,710,400                  OP700340
  707 CONTINUE                                                         OP700350
      GO TO 400                                                        OP700360
C     CHANGE FLAG ON SYSTEM TO OPERATIONAL                             OP700370
  710 IF(ISYSTP-1)750,750,751                                          OP700380
  751 CALL SYSOP(IRRSYS,ISYSNO,IFROM,ITO,NUM4,50,K,KK,I)               OP700390
      IRRSYS(I)=IRRSYS(I)-1                                            OP700400
      GO TO 752                                                        OP700410
  750 CALL SYSOP(ICBSYS,ISYSNO,IFROM,ITO,NUM4,K,KK,I)                  OP700420
      ICBSYS(I)=ICBSYS(I)-1                                            OP700430
C     WRITE PLAYER MESSAGE                                             OP700440
  752 WRITE(6,711)SYSTYP(ISYSTP),ISYSNO,K,KK                           OP700450
  711 FORMAT(/A4,14H SYSTEM NUMBER,I2,10H FROM SITE,I3,8H TO SITE,I3,  OP700460
     118H IS NOW OPERATING.)                                           OP700470
C                                                                       OP700480
  400 RETURN                                                           OP700490
      END                                                              OP700500

      SUBROUTINE OP26(IFROM,ITO,ISYSNO)                                OP200010
C                                                                       OP200020
C     THIS SUBROUTINE DETERMINES IF OPERATIONAL AN/GRC-26 WILL ENABLE  OP200030
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C      NON-OPERATIONAL H-F SYSTEM TO WORK
C
       COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),
      1IGRC50(140),ITCC7(56),IGRC25(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),
      2IDUM1(30),IGEN(54),LCCHQ(22)
C
       J=ISYSNO*100+IFROM
       DO 902 I=1,21
C      IS RADIO ON H-F SYSTEM?
       IF(IGRC26(I)-(IGRC26(I)/10)*10-3)902,903,902
C      IS SYSTEM AND SITE NUMBER CORRECT
   903 IF((IGRC26(I)-(IGRC26(I)/100000)*100000)/100-J)902,904,902
C      IS RADIO OPERATIONAL?
   904 IF((IGRC26(I)-(IGRC26(I)/100)*100)/10)906,906,400
   902 CONTINUE
       GO TO 400
C      CHANGE FLAG ON SYSTEM TO OPERATIONAL
   906 CALL SYSOP(IHFSYS,ISYSNO,IFROM,ITO,NUM4,20,K,KK,I)
       IHFSYS(I)=IHFSYS(I)-1
C      WRITE PLAYER MESSAGE
       WRITE(6,911)ISYSNO,K,KK
   911 FORMAT(/18H H-F SYSTEM NUMBER,I2,10H FROM SITE,I3,8H TO SITE,I3,
      118H IS NOW OPERATING.)
C
   400 RETURN
       END


       SUBROUTINE VEHBKD(IVEHTP)
C
C      THIS SUBROUTINE DETERMINES THE TIME FOR VEHICLE REPAIR, PRINTS AN
C      ESTIMATE FOR THE PLAYERS, AND SCHEDULES REPAIR EVENT
C
       DOUBLE PRECISION VEHID,EQUIP
       COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),
      1IGRC50(140),ITTC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),
      2IDUM1(30),IGEN(54),LCCHQ(22)
       COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)
       COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR
       COMMON/C6/IX
C
C      CHANGE VEHICLE DEADLINE PARAMETER, PRINT MESSAGE, DETERMINE IF
C      VEHICLE IS IN TRANSIT
       INUM=IEVCUR-(IEVCUR/1000)*1000
       GO TO(6,7,8,9,10),IVEHTP
     6 ITO=(IM103(INUM)-(IM103(INUM)/10000)*10000)/100
       IM103(INUM)=IM103(INUM)+10
       ITR=IM103(INUM)-(IM103(INUM)/10)*10
      GO TO 11                                                          VEH00210
    7 ITO=(IMCC6(INUM)-(IMCC6(INUM)/10000)*10000)/100                   VEH00220
      IMCC6(INUM)=IMCC6(INUM)+10                                        VEH00230
      ITR=IMCC6(INUM)-(IMCC6(INUM)/10)*10                               VEH00240
      GO TO 11                                                          VEH00250
    8 ITO=(IM102(INUM)-(IM102(INUM)/10000)*10000)/100                   VEH00260
      IM102(INUM)=IM102(INUM)+10                                        VEH00270
      ITR=IM102(INUM)-(IM102(INUM)/10)*10                               VEH00280
      GO TO 11                                                          VEH00290
    9 ITO=(IV26(INUM)-(IV26(INUM)/10000)*10000)/100                     VEH00300
      IV26(INUM)=IV26(INUM)+10                                          VEH00310
      ITR=IV26(INUM)-(IV26(INUM)/10)*10                                 VEH00320
      GO TO 11                                                          VEH00330
   10 ITO=(IGEN(INUM)-(IGEN(INUM)/10000)*10000)/100                     VEH00340
      IGEN(INUM)=IGEN(INUM)+10                                          VEH00350
      ITR=IGEN(INUM)-(IGEN(INUM)/10)*10                                 VEH00360
      IF(ITR)63,63,62                                                   VEH00370
   62 WRITE(6,13)INUM,ITO                                               VEH00380
   13 FORMAT(/17H GENERATOR NUMBER,I3,19H IN TRANSIT TO SITE,I3,        VEH00390
     117H HAS BROKEN DOWN.)                                             VEH00400
      GO TO 1                                                           VEH00410
   63 WRITE(6,64)INUM                                                   VEH00420
   64 FORMAT(/17H GENERATOR NUMBER,I3,17H HAS BEEN DAMAGED)             VEH00430
      GO TO 1                                                           VEH00440
C                                                                       VEH00450
   11 IF(ITR)50,50,51                                                   VEH00460
   51 WRITE(6,12)VEHID(IVEHTP),INUM,ITO                                 VEH00470
   12 FORMAT(/A9,6HNUMBER,I3,19H IN TRANSIT TO SITE,I3,                 VEH00480
     117H HAS BROKEN DOWN.)                                             VEH00490
      GO TO 1                                                           VEH00500
   50 WRITE(6,53)VEHID(IVEHTP),INUM                                     VEH00510
   53 FORMAT(/A9,6HNUMBER,I3,17H HAS BEEN DAMAGED)                      VEH00520
C     CALCULATE TIME FOR REPAIR                                         VEH00530
    1 CALL GAUSS(IX,90.,180.,REP)                                       VEH00540
      IF(REP)1,2,2                                                      VEH00550
    2 IREP=REP                                                          VEH00560
C     CALCULATE AND PRINT ESTIMATE                                      VEH00570
    3 CALL GAUSS(IX,REP/3.,REP,EST)                                     VEH00580
      IF(EST)3,4,4                                                      VEH00590
    4 IEST=EST                                                          VEH00600
      IHOUR=0                                                           VEH00610
  252 IF(IEST-60)250,251,251                                            VEH00620
  251 IHOUR=IHOUR+1                                                     VEH00630
      IEST=IEST-60                                                      VEH00640
      GO TO 252                                                         VEH00650
  250 WRITE(6,253)IHOUR,IEST                                            VEH00660
  253 FORMAT(/5X,24HESTIMATED REPAIR TIME IS,I3,6H HOURS,I3,5H MIN.)    VEH00670
C     SCHEDULE REPAIR EVENT                                             VEH00680
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      IEVCAL(100)=60000+IVEHTP*1000+INUM                                VEH00690
      JEVCAL(100)=ITIME+IREP                                            VEH00700
      CALL ORDERT                                                       VEH00710
C                                                                       VEH00720
      RETURN                                                            VEH00730
      END                                                               VEH00740


      SUBROUTINE VEHREP(IVEHTP)                                         VEH00010
C                                                                       VEH00020
C     THIS SUBROUTINE REPAIRS VEHICLES AND SCHEDULES ARRIVAL EVENTS     VEH00030
C                                                                       VEH00040
      DOUBLE PRECISION VEHID,EQUIP                                      VEH00050
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      VEH00060
     1IGRC50(140),ITCC7(56),IGPC25(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),VEH00070
     2IDUM(30),IGEN(54),LOCHQ(22)                                       VEH00080
      COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)            VEH00090
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR                    VEH00100
      COMMON/C6/IX                                                      VEH00110
C                                                                       VEH00120
C     FNND DISTANCE TO DESTINATION, CHANGE VEHICLE DEADLINED PARAMETER, VEH00130
C     AND DETERMINE DISTANCE TO NEXT BREAKDOWN                          VEH00140
      INUM=IEVCUR-(IEVCUR/1000)*1000                                    VEH00150
      GO TO(6,7,8,9,10),IVEHTP                                          VEH00160
    6 ITO=(IM103(INUM)-(IM103(INUM)/10000)*10000)/100                   VEH00170
      IDIST=IM103(INUM)/10000                                           VEH00180
      IM103(INUM)=IM103(INUM)-IDIST*10000                               VEH00190
   13 CALL GAUSS(IX,100.,200.,BKD)                                      VEH00200
      IF(BKD)13,13,14                                                   VEH00210
   14 IBKD=BKD                                                          VEH00220
      IM103(INUM)=IM103(INUM)+IBKD*10000-10                             VEH00230
      ITR=IM103(INUM)-(IM103(INUM)/10)*10                               VEH00240
      GO TO 11                                                          VEH00250
    7 ITO=(IMCC6(INUM)-(IMCC6(INUM)/10000)*10000)/100                   VEH00260
      IDIST=IMCC6(INUM)/10000                                           VEH00270
      IMCC6(INUM)=IMCC6(INUM)-IDIST*10000                               VEH00280
   15 CALL GAUSS(IX,100.,200.,BKD)                                      VEH00290
      IF(BKD)15,16,16                                                   VEH00300
   16 IBKD=BKD                                                          VEH00310
      IMCC6(INUM)=IMCC6(INUM)+IBKD*10000-10                             VEH00320
      ITR=IMCC6(INUM)-(IMCC6(INUM)/10)*10                               VEH00330
      GO TO 11                                                          VEH00340
    8 ITO=(IM102(INUM)-(IM102(INUM)/10000)*10000)/100                   VEH00350
      IDIST=IM102(INUM)/10000                                           VEH00360
      IM102(INUM)=IM102(INUM)-IDIST*10000                               VEH00370
   17 CALL GAUSS(IX,100.,200.,BKD)                                      VEH00380
      IF(BKD)17,18,18                                                   VEH00390
   18 IBKD=BKD                                                          VEH00400
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      IM102(INUM)=IM102(INUM)+IBKD*10000-10                             VEH00410
      ITR=IM102(INUM)-(IM102(INUM)/10)*10                               VEH00420
      GO TO 11                                                          VEH00430
    9 ITO=(IV26(INUM)-(IV26(INUM)/10000)*10000)/100                     VEH00440
      IDIST=IV26(INUM)/10000                                            VEH00450
      IV26(INUM)=IV26(INUM)-IDIST*10000                                 VEH00460
   19 CALL GAUSS(IX,100.,200.,BKD)                                      VEH00470
      IF(BKD)19,20,20                                                   VEH00480
   20 IBKD=BKD                                                          VEH00490
      IV26(INUM)=IV26(INUM)+IBKD*10000-10                               VEH00500
      ITR=IV26(INUM)-(IV26(INUM)/10)*10                                 VEH00510
      GO TO 11                                                          VEH00520
   10 ITO=(IGEN(INUM)-(IGEN(INUM)/10000)*10000)/100                     VEH00530
      IDIST=IGEN(INUM)/10000                                            VEH00540
      IGEN(INUM)=IGEN(INUM)-IDIST*10000                                 VEH00550
   21 CALL GAUSS(IX,100.,200.,BKD)                                      VEH00560
      IF(BKD)21,22,22                                                   VEH00570
   22 IBKD=BKD                                                          VEH00580
      IGEN(INUM)=IGEN(INUM)+IBKD*10000-10                               VEH00590
      ITR=IGEN(INUM)-(IGEN(INUM)/10)*10                                 VEH00600
      IF(ITR)60,60,62                                                   VEH00610
   60 WRITE(6,61)INUM,ITO                                               VEH00620
   61 FORMAT(/17H GENERATOR NUMBER,I3,16H LOCATED AT SITE,I3,           VEH00630
     119H HAS BEEN REPAIRED.)                                           VEH00640
      RETURN                                                            VEH00650
   11 IF(ITR)50,50,51                                                   VEH00660
   50 WRITE(6,52)VEHID(IVEHTP),INUM,ITC                                 VEH00670
   52 FORMAT(/A9,6HNUMBER,I3,16H LOCATED AT SITE,I3,                    VEH00680
     119H HAS BEEN REPAIRED.)                                           VEH00690
      RETURN                                                            VEH00700
   62 WRITE(6,23)INUM,ITC                                               VEH00710
   23 FORMAT(/17H GENERATOR NUMBER,I3,44H HAS BEEN REPAIRED AND IS PROCEVEH00720
     1EDING TO SITE,I3)                                                 VEH00730
      GO TO 24                                                          VEH00740
C                                                                       VEH00750
C     PRINT MESSAGE                                                     VEH00760
   51 WRITE(6,1)VEHID(IVEHTP),INUM,ITC                                  VEH00770
    1 FORMAT(/A9,6HNUMBER,I3,44H HAS BEEN REPAIRED AND IS PROCEEDING TO VEH00780
     1SITE,I3)                                                          VEH00790
C     SCHEDULE ARRIVAL EVENT                                            VEH00800
   24 ITIME1=IDIST*(60./18.)                                            VEH00810
      IEVCAL(100)=40000+IVEHTP*1000+INUM                                VEH00820
      JEVCAL(100)=ITIME+ITIME1                                          VEH00830
      CALL ORDERT                                                       VEH00840
C                                                                       VEH00850
      RETURN                                                            VEH00860
      END                                                               VEH00870

      SUBROUTINE SITACK                                                 SIT00010
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C                                                                       SIT00020
C     THIS SUBROUTINE PROCESSES SITE ATTACKS BY CAUSING EQUIPMENT AND   SIT00030
C     VEHICLES TO FAIL IN ACCORDANCE WITH THE SITE RISK CATAGORY. A NEW SIT00040
C     ATTACK TIME IS DETERMINED FOR ATTACKED SITE.                      SIT00050
C                                                                       SIT00060
      DOUBLE PRECISION VEHID,EQUIP                                      SIT00070
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      SIT00080
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),SIT00090
     2IDUM1(30),IGEN(54),LOCHQ(22)                                      SIT00100
      COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)            SIT00110
      COMMON/C4/IG50FL(140),IT7FL(56),IG26FL(21),IGENFL(54),ISITFL(30)  SIT00120
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR                    SIT00130
      COMMON/C6/IX                                                      SIT00140
C                                                                       SIT00150
C     DETERMINE PROBABILITY OF EQUIPMENT FAILURE AND ESTABLISH NEW SITE SIT00160
C     ATTACK TIME                                                       SIT00170
      ISITE=IEVCUR-(IEVCUR/1000)*1000                                   SIT00180
      ITYPE=LOCSIT(ISITE)/1000000                                       SIT00190
      IDUM2=3*ITYPE-2                                                   SIT00200
      IF(ITYPE.EQ.99)IDUM2=67                                           SIT00210
      WRITE(6,70)ISITE,HQ(IDUM2),HQ(IDUM2+1),HQ(IDUM2+2)                SIT00220
   70 FORMAT(/5H SITE,I3,2H (,3A4,20H) HAS BEEN ATTACKED.)              SIT00230
      CALL RANDU(IX,IY,YFL)                                             SIT00240
      IX=IY                                                             SIT00250
      IF(ITYPE-3)1,1,2                                                  SIT00260
    1 PROB=.3                                                           SIT00270
      ISITFL(ISITE)=YFL*115200.                                         SIT00280
      GO TO 3                                                           SIT00290
    2 IF(ITYPE-99)4,5,4                                                 SIT00300
    5 PROB=.7                                                           SIT00310
      ISITFL(ISITE)=YFL*86400.                                          SIT00320
      GO TO 3                                                           SIT00330
    4 PROB=.5                                                           SIT00340
      ISITFL(ISITE)=YFL*28800.                                          SIT00350
C                                                                       SIT00360
C     CHECK EACH MRC-103                                                SIT00370
    3 DO 6 I=1,32                                                       SIT00380
C     IS MRC-103 AT SITE?                                               SIT00390
      IF((IM103(I)-(IM103(I)/10000)*10000)/100-ISITE)6,7,6              SIT00400
C     IS VEH IN TRANSIT?                                                SIT00410
    7 IF(IM103(I)-(IM103(I)/10)*10)6,12,6                               SIT00420
C     IS VEH DAMAGED BY ATTACK?                                         SIT00430
   12 CALL RANDU(IX,IY,YFL)                                             SIT00440
      IX=IY                                                             SIT00450
      IF(YFL-PROB)8,9,9                                                 SIT00460
C     IS VEH ALREADY DEADLINED?                                         SIT00470
    8 IF((IM103(I)-(IM103(I)/100)*100)/10)10,10,9                       SIT00480
C     CALL BREAKDOWN SUBROUTINE                                         SIT00490
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   10 IEVCUR=50000+I                                                        SIT00500
      CALL VEHBKD(1)                                                        SIT00510
C     CHECK GRC-50'S IN VEH FOR FAILURE                                     SIT00520
    9 IBOT=I*3+42                                                           SIT00530
      ITOP=IBOT+2                                                           SIT00540
      DO 13 J=IBOT,ITOP                                                     SIT00550
C     IS GRC-50 DEADLINED ALREADY?                                          SIT00560
      IF((IGRC50(J)-(IGRC50(J)/100)*100)/10)15,15,13                        SIT00570
C     IS RADIO DAMAGED BY ATTACK                                            SIT00580
   15 CALL RANDU(IX,IY,YFL)                                                 SIT00590
      IX=IY                                                                 SIT00600
      IF(YFL-PROB)14,13,13                                                  SIT00610
   14 IEVCUR=11000+J                                                        SIT00620
      CALL EQFAIL                                                           SIT00630
   13 CONTINUE                                                              SIT00640
    6 CONTINUE                                                              SIT00650
C                                                                           SIT00660
C     MCC-6                                                                 SIT00670
C     SAME COMMENTS AS IN MRC-103 APPLY                                     SIT00680
      DO 16 I=1,17                                                          SIT00690
      IF((IMCC6(I)-(IMCC6(I)/10000)*10000)/100-ISITE)16,17,16               SIT00700
   17 IF(IMCC6(I)-(IMCC6(I)/10)*10)16,22,16                                 SIT00710
   22 CALL RANDU(IX,IY,YFL)                                                 SIT00720
      IX=IY                                                                 SIT00730
      IF(YFL-PROB)18,19,19                                                  SIT00740
   18 IF((IMCC6(I)-(IMCC6(I)/100)*100)/10)20,20,19                          SIT00750
   20 IEVCUR=50000+I                                                        SIT00760
      CALL VEHBKD(2)                                                        SIT00770
   19 IBOT=I*2+21                                                           SIT00780
      ITOP=IBOT+1                                                           SIT00790
      DO 23 J=IBOT,ITOP                                                     SIT00800
      IF((ITCC7(J)-(ITCC7(J)/100)*100)/10)25,25,13                          SIT00810
   25 CALL RANDU(IX,IY,YFL)                                                 SIT00820
      IX=IY                                                                 SIT00830
      IF(YFL-PROB)24,23,23                                                  SIT00840
   24 IEVCUR=12000+J                                                        SIT00850
      CALL EQFAIL                                                           SIT00860
   23 CONTINUE                                                              SIT00870
   16 CONTINUE                                                              SIT00880
C                                                                           SIT00890
C     MRC-102                                                               SIT00900
      DO 26 I=1,22                                                          SIT00910
      IF((IM102(I)-(IM102(I)/10000)*10000)/100-ISITE)26,27,26               SIT00920
   27 IF(IM102(I)-(IM102(I)/10)*10)26,32,26                                 SIT00930
   32 CALL RANDU(IX,IY,YFL)                                                 SIT00940
      IX=IY                                                                 SIT00950
      IF(YFL-PROB)28,29,29                                                  SIT00960
   28 IF((IM102(I)-(IM102(I)/100)*100)/10)30,30,29                          SIT00970
   30 IEVCLR=50000+I                                                    SIT00980
      CALL VEHBKD(3)                                                    SIT00990
   29 IBOT=I*2-1                                                        SIT01000
      ITOP=IBOT+1                                                       SIT01010
      DO 33 J=IBOT,ITOP                                                 SIT01020
      IF((IGRC50(I)-(IGRC50(I)/100)*100)/10)35,35,33                    SIT01030
   35 CALL RANDU(IX,IY,YFL)                                             SIT01040
      IX=IY                                                             SIT01050
      IF(YFL-PROB)34,33,33                                              SIT01060
   34 IEVCUR=11000+J                                                    SIT01070
      CALL EQFAIL                                                       SIT01080
   33 CONTINUE                                                          SIT01090
      IF((ITCC7(I)-(ITCC7(I)/100)*100)/10)85,85,26                      SIT01100
   85 CALL RANDU(IX,IY,YFL)                                             SIT01110
      IX=IY                                                             SIT01120
      IF(YFL-PROB)84,26,26                                              SIT01130
   84 IEVCUR=12000+I                                                    SIT01140
      CALL EQFAIL                                                       SIT01150
   26 CONTINUE                                                          SIT01160
C                                                                       SIT01170
C     GRC-26                                                            SIT01180
      DO 36 I=1,21                                                      SIT01190
      IF((IV26(I)-(IV26(I)/10000)*10000)/100-ISITE)36,37,36             SIT01200
   37 IF(IV26(I)-(IV26(I)/10)*10)36,42,36                               SIT01210
   42 CALL RANDU(IX,IY,YFL)                                             SIT01220
      IX=IY                                                             SIT01230
      IF(YFL-PROB)38,39,39                                              SIT01240
   38 IF((IV26(I)-(IV26(I)/100)*100)/10)40,40,39                        SIT01250
   40 IEVCUR=50000+I                                                    SIT01260
      CALL VEHBKD(4)                                                    SIT01270
   39 IF((IGRC26(I)-(IGRC26(I)/100)*100)/10)45,45,36                    SIT01280
   45 CALL RANDU(IX,IY,YFL)                                             SIT01290
      IX=IY                                                             SIT01300
      IF(YFL-PROB)44,36,36                                              SIT01310
   44 IEVCUR=14000+I                                                    SIT01320
      CALL EQFAIL                                                       SIT01330
   36 CONTINUE                                                          SIT01340
C                                                                       SIT01350
C     GENERATORS                                                        SIT01360
      DO 56 I=1,54                                                      SIT01370
      IF((IGEN(I)-(IGEN(I)/10000)*10000)/100-ISITE)56,57,56             SIT01380
   57 IF(IGEN(I)-(IGEN(I)/10)*10)56,62,56                               SIT01390
   62 CALL RANDU(IX,IY,YFL)                                             SIT01400
      IX=IY                                                             SIT01410
      IF(YFL-PROB)58,56,56                                              SIT01420
   58 IF((IGEN(I)-(IGEN(I)/100)*100)/10)60,60,56                        SIT01430
   60 IEVCUR=50000+I                                                    SIT01440
      CALL VEHBKD(5)                                                    SIT01450
   56 CONTINUE                                                          SIT01460
C                                                                       SIT01470
      RETURN                                                            SIT01480
      END                                                               SIT01490

      SUBROUTINE EQREM(ITYPE)                                           EQRC0010
C                                                                       EQRC0020
C     THIS SUBROUTINE REMOVES EQUIPMENT FROM A SYSTEM ON PLAYERS REQUESTEQRC0030
C                                                                       EQRC0040
      DOUBLE PRECISION VEHID,EQUIP                                      EQRC0050
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      EQRC0060
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),EQRC0070
     2IDUM1(30),IGEN(54),LCCHQ(22)                                      EQRC0080
      COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)            EQRC0090
      COMMON/C4/IG50FL(140),IT7FL(56),IG26FL(21),IGENFL(54)             EQRC0100
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR                    EQRC0110
C                                                                       EQRC0120
      NUM4=0                                                            EQRC0130
      GO TO(1,2,3),ITYPE                                                EQRC0140
C                                                                       EQRC0150
C     GRC-50                                                            EQRC0160
C     PRINT MESSAGE AND RECEIVE DATA                                    EQRC0170
    1 WRITE(6,10)EQUIP(1)                                               EQRC0180
   10 FORMAT(/8H REMOVE ,A8,11HFROM SYSTEM//28H SITE NO, SYSTEM NO, TO SEQRC0190
     1ITE/8H XX X XX)                                                   EQRC0200
      READ(5,11)ISITE1,ISYSNO,ISITE2                                    EQRC0210
   11 FORMAT(2I2,I3)                                                    EQRC0220
      WRITE(6,12)ISITE1,ISYSNO,ISITE2                                   EQRC0230
   12 FORMAT(I3,I2,I3)                                                  EQRC0240
C     DOES SYSTEM EXIST AT SITE?                                        EQRC0250
      CALL SYSOP(IRRSYS,ISYSNO,ISITE1,ISITE2,NUM4,50,IFROM,ITO,II)      EQRC0260
      IF(NUM4-3)13,14,14                                                EQRC0270
   14 WRITE(6,15)                                                       EQRC0280
   15 FORMAT(/22H SYSTEM DOES NOT EXIST)                                EQRC0290
      GO TO 100                                                         EQRC0300
C     IS GRC-50 CONNECTED TO SYSTEM                                     EQRC0310
   13 J=ISYSNO*100+ISITE2                                               EQRC0320
      DO 16 I=1,140                                                     EQRC0330
      IF((IGRC50(I)-(IGRC50(I)/100000)*100000)/100-J)16,17,16           EQRC0340
   17 IVEHNO=(IGRC50(I)-(IGRC50(I)/10000000)*10000000)/100000           EQRC0350
      IVEHTP=IGRC50(I)/10000000                                         EQRC0360
      IF(IVEHTP-1)19,19,20                                              EQRC0370
   19 NUM2=3                                                            EQRC0380
      IF((IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100-ISITE1)16,21,16EQRC0390
   20 NUM2=1                                                            EQRC0400
      IF((IM103(IVEHNO)-(IM103(IVEHNO)/10000)*10000)/100-ISITE1)16,21,16EQRC0410
   16 CONTINUE                                                          EQRC0420
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60 WRITE(6,18)EQUIP(ITYPE),ISITE1
18 FORMAT(/4H NO ,A8,28HCONNECTED TO SYSTEM AT SITE ,I2)
   GO TO 100
21 ISYSTP=2
C     REMOVE GRC-50 FROM SYSTEM
   IGRC50(I)=IGRC50(I)-J*100
   WRITE(6,22)EQUIP(ITYPE),VEHID(NUM2),IVEHNO,ISITE1,SYSTYP(ISYSTP),
  1ISYSNO,IFROM,ITO
22 FORMAT(/A9,3HIN ,A8,6HNUMBER,I3,8H AT SITE,I3,22H HAS BEEN REMOVED
  1 FROM,A4/14H SYSTEM NUMBER,I2,10H FROM SITE,I3,8H TO SITE,I3,1H.)
C     IF FAILURE IS IN FUTURE EVENTS TABLE REMOVE IT
   DO 90 K=1,100
   IF(IEVCAL(K)-(11000+I))90,91,90
91 IG50FL(I)=JEVCAL(K)-ITIME
   DO 92 L=K,99
   IEVCAL(L)=IEVCAL(L+1)
92 JEVCAL(L)=JEVCAL(L+1)
   IEVCAL(100)=0
   JEVCAL(100)=0
90 CONTINUE
C     DOES THIS MAKE SYSTEM NON-OPERATIVE?
36 IF(IRRSYS(II)-(IRRSYS(II)/10)*10)23,23,100
C     CHANGE SYSTEM STATUS
23 IRRSYS(II)=IRRSYS(II)+1
38 WRITE(6,24)SYSTYP(ISYSTP),ISYSNO,IFROM,ITO
24 FORMAT(/A5,13HSYSTEM NUMBER,I2,10H FROM SITE,I3,8H TO SITE,I3,
  124H IS NOW NON-OPERATIONAL.)
   GO TO 100
C
C     TCC-7
C     PRINT MESSAGE AND RECEIVE DATA
 2 WRITE(6,25)
25 FORMAT(/25H REMOVE TCC-7 FROM SYSTEM/59H SITE NO, SYSTEM NO, TO SI
  1TE, SYSTEM TYPE (1 = CBL, 2 = RR)/10H XX X XX X)
   READ(5,26)ISITE1,ISYSNO,ISITE2,ISYSTP
26 FORMAT(2I2,I3,I2)
   WRITE(6,27)ISITE1,ISYSNO,ISITE2,ISYSTP
27 FORMAT(I3,I2,I3,I2)
C     DOES SYSTEM EXIST AT SITE
   GO TO(29,28),ISYSTP
28 CALL SYSOP(IRRSYS,ISYSNO,ISITE1,ISITE2,NUM4,50,IFROM,ITO,II)
   GO TO 50
29 CALL SYSOP(ICBSYS,ISYSNO,ISITE1,ISITE2,NUM4,10,IFROM,ITO,II)
50 IF(NUM4-3)51,14,14
C     IS TCC-7 CONNECTED TO SYSTEM?
51 J=ISYSNO*100+ISITE2
   DO 30 I=1,50
   IF((ITCC7(I)-(ITCC7(I)/100000)*100000)/100-J)30,31,30
   31 IVEHNO=(ITCC7(I)-(ITCC7(I)/10000000)*10000000)/100000              EQR00910
      IVEHTP=ITCC7(I)/10000000                                          EQR00920
      IF(IVEHTP-1)32,32,33                                              EQR00930
   32 NUM2=3                                                            EQR00940
      IF((IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100-ISITE1)30,34,30EQR00950
   33 NUM2=2                                                            EQR00960
      IF((IMCC6(IVEHNO)-(IMCC6(IVEHNO)/10000)*10000)/100-ISITE1)30,34,30EQR00970
   30 CONTINUE                                                          EQR00980
      GO TO 60                                                          EQR00990
C     REMOVE TCC-7 FROM SYSTEM                                          EQR01000
   34 ITCC7(I)=ITCC7(I)-J*100                                           EQR01010
      WRITE(6,22)EQUIP(ITYPE),VEHID(NUM2),IVEHNO,ISITE1,SYSTYP(ISYSTP), EQR01020
     1ISYSNO,IFROM,ITO                                                  EQR01030
C     IF FAILURE IS IN FUTURE EVENTS TABLE REMOVE IT                    EQR01040
      DO 93 K=1,100                                                     EQR01050
      IF(IEVCAL(K)-(12000+I))93,94,93                                   EQR01060
   94 IT7FL(I)=JEVCAL(K)-ITIME                                          EQR01070
      DO 95 L=K,99                                                      EQR01080
      IEVCAL(L)=IEVCAL(L+1)                                             EQR01090
   95 JEVCAL(L)=JEVCAL(L+1)                                             EQR01100
      IEVCAL(100)=0                                                     EQR01110
      JEVCAL(100)=0                                                     EQR01120
   93 CONTINUE                                                          EQR01130
C     DOES THIS MAKE SYSTEM NON-OPERATIVE?                              EQR01140
      GO TO(35,36),ISYSTP                                               EQR01150
   35 IF(ICBSYS(II)-(ICBSYS(II)/10)*10)37,37,100                        EQR01160
   37 ICBSYS(II)=ICBSYS(II)+1                                           EQR01170
      GO TO 38                                                          EQR01180
C                                                                       EQR01190
C     GRC-26                                                            EQR01200
C     PRINT MESSAGE AND RECEIVE DATA                                    EQR01210
    3 WRITE(6,10)EQUIP(3)                                               EQR01220
      READ(5,11)ISITE1,ISYSNO,ISITE2                                    EQR01230
      WRITE(6,12)ISITE1,ISYSNO,ISITE2                                   EQR01240
C     DOES SYSTEM EXIST AT SITE                                         EQR01250
      CALL SYSOP(IHFSYS,ISYSNO,ISITE1,ISITE2,NUM4,20,IFROM,ITO,II)      EQR01260
      IF(NUM4-3)39,14,14                                                EQR01270
C     IS GRC-26 CONNECTED TO SYSTEM                                     EQR01280
   39 J=ISYSNO*100+ISITE2                                               EQR01290
      DO 41 I=1,21                                                      EQR01300
      IF((IGRC26(I)-(IGRC26(I)/100000)*100000)/100-J)41,80,41           EQR01310
   80 IF((IV26(I)-(IV26(I)/10000)*10000)/100-ISITE1)41,42,41            EQR01320
   41 CONTINUE                                                          EQR01330
      GO TO 60                                                          EQR01340
C     REMOVE GRC-26 FROM SYSTEM                                         EQR01350
   42 IGRC26(I)=IGRC26(I)-J*100                                         EQR01360
      WRITE(6,22)EQUIP(ITYPE),VEHID(4),I,ISITE1,SYSTYP(ITYPE),ISYSNO,   EQR01370
     1IFROM,ITO                                                         EQR01380
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C       IF FAILURE EXISTS IN FUTURE EVENTS TABLE REMOVE IT                  EQRC1390
        DO 96 K=1,100                                                       EQRC1400
        IF(IEVCAL(K)-(13000+I))96,97,96                                     EQRC1410
   97   IG26FL(I)=JEVCAL(K)-ITIME                                           EQRC1420
        DO 98 L=K,99                                                        EQRC1430
        IEVCAL(L)=IEVCAL(L+1)                                               EQRC1440
   98   JEVCAL(L)=JEVCAL(L+1)                                               EQRC1450
        IEVCAL(100)=0                                                       EQRC1460
        JEVCAL(100)=0                                                       EQRC1470
   96   CONTINUE                                                            EQRC1480
C       DOES THIS MAKE SYSTEM NON-OPERATIVE?                                EQRC1490
        IF(IHFSYS(II)-(IHFSYS(II)/10)*10)43,43,100                          EQRC1500
C       CHANGE SYSTEM STATUS                                                EQRC1510
   43   IHFSYS(II)=IHFSYS(II)+1                                             EQRC1520
        WRITE(6,24)SYSTYP(ITYPE),ISYSNO,IFROM,ITO                           EQRC1530
C                                                                           EQRC1540
  100   RETURN                                                              EQRC1550
        END                                                                 EQRC1560


        SUBROUTINE EQINST(NUMB)                                             EQIC0010
C                                                                           EQIC0020
C       THIS SUBROUTINE SCHEDULES INSTALLATION EVENTS AND INSTALLS EQUIP-   EQIC0030
C       MENT ON PLAYERS REQUEST                                             EQIC0040
C                                                                           EQIC0050
        DOUBLE PRECISION VEHID,EQUIP                                        EQIC0060
        COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),        EQIC0070
       1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),EQIC0080
       2IDUM1(30),IGEN(54),LCCHQ(22)                                        EQIC0090
        COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)              EQIC0100
        COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR                      EQIC0110
        COMMON/C6/IX                                                        EQIC0120
C                                                                           EQIC0130
        NUM4=0                                                              EQIC0140
        GO TO (1,2,3,4,4,4),NUMB                                            EQIC0150
C                                                                           EQIC0160
C       GRC-50                                                              EQIC0170
C       WRITE MESSAGE AND RECEIVE INPUT                                     EQIC0180
    1   WRITE(6,7)EQUIP(1)                                                  EQIC0190
    7   FORMAT(/9H INSTALL ,A8,10H ON SYSTEM//69H SITE NO, VEH TYPE (1=MRCEQIC0200
       1-103, 2=MRC-102), VEH NO, SYSTEM NO, TO SITE/13H XX X XX X XX)     EQIC0210
        READ(5,8)ISITE1,IVEH,IVEHNO,ISYSNO,ISITE2                           EQIC0220
    8   FORMAT(2I2,I3,I2,I3)                                                EQIC0230
        WRITE(6,9)ISITE1,IVEH,IVEHNO,ISYSNO,ISITE2                          EQIC0240
    9   FORMAT(I2,I2,I3,I2,I3)                                              EQIC0250
C       IS VEHICLE AT SITE OR IN TRANSIT?                                   EQIC0260
        ISYSTP=2                                                            EQIC0270
        GO TO(10,11),IVEH                                                   EQIC0280
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C     MRC-103                                                           EQIO0290
   10 NUM2=1                                                            EQIO0300
      IF((IM103(IVEHNO)-(IM103(IVEHNO)/10000)*10000)/100-ISITE1)12,13,12EQIO0310
   13 IF(IM103(IVEHNO)-(IM103(IVEHNO)/10)*10)15,15,16                   EQIO0320
   12 WRITE(6,14)VEHID(NUM2),IVEHNO,ISITE1                              EQIO0330
   14 FORMAT(/A9,6HNUMBER,I3,23H IS NOT LOCATED AT SITE,I3)             EQIO0340
      GO TO 100                                                         EQIO0350
   16 WRITE(6,17)VEHID(NUM2),IVEHNO                                     EQIO0360
   17 FORMAT(/A9,6HNUMBER,I3,14H IS IN TRANSIT)                         EQIO0370
      GO TO 100                                                         EQIO0380
C     MRC-102                                                           EQIO0390
   11 NUM2=3                                                            EQIO0400
      IF((IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100-ISITE1)12,18,12EQIO0410
   18 IF(IM102(IVEHNO)-(IM102(IVEHNO)/10)*10)15,15,16                   EQIO0420
C     DOES SYSTEM EXIST AT SITE?                                        EQIO0430
   15 CALL SYSOP(IRRSYS,ISYSNO,ISITE1,ISITE2,NUM4,50,IFROM,ITO,II)      EQIO0440
      IF(NUM4-3)19,20,20                                                EQIO0450
   20 WRITE(6,21)                                                       EQIO0460
   21 FORMAT(/22H SYSTEM DOES NOT EXIST)                                EQIO0470
      GO TO 100                                                         EQIO0480
C     IS EQUIP CONNECTED TO SYSTEM ALREADY?                             EQIO0490
   19 J=ISYSNO*100+ISITE2                                               EQIO0500
      DO 22 I=1,140                                                     EQIO0510
      IF((IGRC50(I)-(IGRC50(I)/100000)*100000)/100-J)22,23,22           EQIO0520
   23 IVEHNU=(IGRC50(I)-(IGRC50(I)/10000000)*10000000)/100000           EQIO0530
      IVEHTP=IGRC50(I)/10000000                                         EQIO0540
      IF(IVEHTP-1)24,24,25                                              EQIO0550
   24 NUM5=3                                                            EQIO0560
      IF((IM102(IVEHNU)-(IM102(IVEHNU)/10000)*10000)/100-ISITE1)22,26,22EQIO0570
   25 NUM5=1                                                            EQIO0580
      IF((IM103(IVEHNU)-(IM103(IVEHNU)/10000)*10000)/100-ISITE1)22,26,22EQIO0590
   26 WRITE(6,27)EQUIP(NUMB),VEHID(NUM5),IVEHNU                         EQIO0600
   27 FORMAT(/A9,2HIN,A9,6HNUMBER,I3,31H IS ALREADY CONNECTED TO SYSTEM)EQIO0610
      GO TO 100                                                         EQIO0620
   22 CONTINUE                                                          EQIO0630
C     IS GRC-50 AVAILABLE AND OPERATIONAL?                              EQIO0640
      GO TO(28,29),IVEH                                                 EQIO0650
C     MRC-103                                                           EQIO0660
   28 IBOT=42+IVEHNO*3                                                  EQIO0670
      ITOP=IBOT+2                                                       EQIO0680
      GO TO 30                                                          EQIO0690
C     MRC-102                                                           EQIO0700
   29 IBOT=IVEHNO*2-1                                                   EQIO0710
      ITOP=IBOT+1                                                       EQIO0720
   30 DO 31 K=IBOT,ITOP                                                 EQIO0730
      IF((IGRC50(K)-(IGRC50(K)/100000)*100000)/100)33,33,31             EQIO0740
   31 CONTINUE                                                          EQIO0750
   71 WRITE(6,34)EQUIP(NUMB)                                            EQIO0760
   34 FORMAT(/11H NO UNUSED ,A7,11H IN VEHICLE)                            EQIC0770
      GO TO 100                                                            EQIC0780
   33 IF((IGRC50(K)-(IGRC50(K)/100)*100)/10)35,35,36                        EQIC0790
   36 IF(K-ITOP)37,38,38                                                   EQIC0800
   37 IBOT=K+1                                                             EQIC0810
      GO TO 30                                                             EQIC0820
   38 WRITE(6,39)EQUIP(NUMB)                                               EQIC0830
   39 FORMAT(/11H NO UNUSED ,A7,34H WHICH IS NOT DEACLINED IN VEHICLE)     EQIC0840
      GO TO 100                                                            EQIC0850
C     SCHEDULE INSTALLATION EVENT AND CHANGE GRC-50 UNIT TO REFLECT        EQIC0860
C     INSTALLATION                                                         EQIC0870
   35 IEVCAL(100)=31000+K                                                  EQIC0880
      IGRC50(K)=(IGRC50(K)/10)*10+100*J+2                                  EQIC0890
   93 CALL GAUSS(IX,5.,15.,TIME1)                                          EQIC0900
      IF(TIME1)93,78,78                                                    EQIC0910
   78 ITIME1=TIME1                                                         EQIC0920
      JEVCAL(100)=ITIME+ITIME1                                             EQIC0930
      CALL ORDERT                                                          EQIC0940
C     PRINT MESSAGE                                                        EQIC0950
      WRITE(6,40)EQUIP(NUMB),VEHID(NUM2),IVEHNO,ISITE1,SYSTYP(ISYSTP),     EQIC0960
     1IFROM,ITO                                                            EQIC0970
   40 FORMAT(/16H INSTALLATION OF,A9,3HIN ,A8,2HNO,I3,16H LOCATED AT SITEQIC0980
     1E,I3/12H HAS BEGUN. ,A4,20H SYSTEM IS FROM SITE,I3,8H TO SITE,I3,    EQIC0990
     21H.)                                                                 EQIC1000
      GO TO 100                                                            EQIC1010
C                                                                          EQIC1020
C     TCC-7                                                                EQIC1030
C     WRITE MESSAGE AND RECEIVE INPUT                                      EQIC1040
    2 WRITE(6,41)                                                          EQIC1050
   41 FORMAT(/24H INSTALL TCC-7 ON SYSTEM//91H SITE NO, VEH TYPE (1=MRC-EQIC1060
     1102, 2=MCC-6), VEH NO, SYSTEM NO, TO SITE, SYS TYPE (1=CBL, 2=RR)/EQIC1070
     215H XX X XX X XX X)                                                  EQIC1080
      READ(5,42)ISITE1,IVEH,IVEHNO,ISYSNO,ISITE2,ISYSTP                    EQIC1090
   42 FORMAT(2I2,I3,I2,I3,I2)                                              EQIC1100
      WRITE(6,43)ISITE1,IVEH,IVEHNO,ISYSNO,ISITE2,ISYSTP                   EQIC1110
   43 FORMAT(I3,I2,I3,I2,I3,I2)                                            EQIC1120
C     IS VEHICLE AT SITE OR IN TRANSIT                                     EQIC1130
      GO TO(50,51),IVEH                                                    EQIC1140
C     MRC-102                                                              EQIC1150
   50 NUM2=3                                                               EQIC1160
      IF((IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100-ISITE1)12,53,12EQIC1170
   53 IF(IM102(IVEHNO)-(IM102(IVEHNO)/10)*10)55,55,16                      EQIC1180
C     MCC-6                                                                EQIC1190
   51 NUM2=2                                                               EQIC1200
      IF((IMCC6(IVEHNO)-(IMCC6(IVEHNO)/10000)*10000)/100-ISITE1)12,58,12EQIC1210
   58 IF(IMCC6(IVEHNO)-(IMCC6(IVEHNO)/10)*10)55,55,16                      EQIC1220
C     DOES SYSTEM EXIST AT SITE?                                           EQIC1230
   55 GO TO(59,60),ISYSTP                                                  EQIC1240
```

```
C       CBL SYSTEM
     59 CALL SYSOP(ICBSYS,ISYSNO,ISITE1,ISITE2,NUM4,10,IFROM,ITO,II)
        GO TO 61
C       RR SYSTEM
     60 CALL SYSOP(IRRSYS,ISYSNO,ISITE1,ISITE2,NUM4,50,IFROM,ITO,II)
     61 IF(NUM4-3)62,20,20
C       IS EQUIPMENT CONNECTED TC SYSTEM ALREADY
     62 J=ISYSNO*100+ISITE2
        DO 63 I=1,56
        IF((ITCC7(I)-(ITCC7(I)/100000)*100000)/100-J)63,64,63
     64 IVEHNU=(ITCC7(I)-(ITCC7(I)/10000000)*10000000)/100000
        IVEHTP=ITCC7(I)/10000000
        IF(IVEHTP-1)65,65,66
C       MRC-102
     65 NUM5=3
        IF((IM102(IVEHNU)-(IM102(IVEHNU)/10000)*10000)/100-ISITE1)63,67,63
C       MCC-6
     66 NUM5=2
        IF((IMCC6(IVEHNU)-(IMCC6(IVEHNU)/10000)*10000)/100-ISITE1)63,67,63
     67 WRITE(6,27)EQUIP(NUMB),VEHID(NUM5),IVEHNO
        GO TO 100
     63 CONTINUE
C       IS TCC-7 AVAILABLE AND OPERATIONAL?
        GO TO(68,69),IVEH
C       MRC-102
     68 K=IVEHNO
        IF((ITCC7(K)-(ITCC7(K)/100000)*100000)/100)73,73,71
     73 IF((ITCC7(K)-(ITCC7(K)/100)*100)/10)77,77,38
C       MCC-6
     69 IBOT=21+2*IVEHNO
        ITOP=IBOT+1
     76 DO 72 K=IBOT,ITOP
        IF((ITCC7(K)-(ITCC7(K)/100000)*100000)/100)70,70,72
     72 CONTINUE
        GO TO 71
     70 IF((ITCC7(K)-(ITCC7(K)/100)*100)/10)77,77,74
     74 IF(K-ITOP)75,38,38
     75 IBOT=K+1
        GO TO 76
C       SCHEDULE INSTALLATION EVENT AND CHANGE TCC-7 UNIT TO REFLECT
C       INSTALLATION
     77 IEVCAL(100)=32000+K
        ITCC7(K)=(ITCC7(K)/10)*10+100*J+ISYSTP
     92 CALL GAUSS(IX,5.,15.,TIME1)
        IF(TIME1)92,78,78
C
C       GRC-26
C       WRITE MESSAGE AND RECEIVE INPUT
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    3 WRITE(6,80)                                                       EQI01730
   80 FORMAT(/25H INSTALL GRC-26 ON SYSTEM//36H SITE NO, VEH NO, SYSTEM EQI01740
     1NO, TO SITE/11H XX XX X XX)                                       EQI01750
      READ(5,81)ISITE1,IVEHNO,ISYSNO,ISITE2                             EQI01760
   81 FORMAT(I2,I3,I2,I3)                                               EQI01770
      WRITE(6,82)ISITE1,IVEHNO,ISYSNO,ISITE2                            EQI01780
   82 FORMAT(2I3,I2,I3)                                                 EQI01790
      NUM2=4                                                            EQI01800
C     IS VEHICLE AT SITE OR IN TRANSIT?                                 EQI01810
      IF((IV26(IVEHNO)-(IV26(IVEHNO)/10000)*10000)/100-ISITE1)12,83,12  EQI01820
   83 IF(IV26(IVEHNO)-(IV26(IVEHNO)/10)*10)84,84,16                     EQI01830
C     DOES SYSTEM EXIST AT SITE?                                        EQI01840
   84 CALL SYSOP(IHFSYS,ISYSNO,ISITE1,ISITE2,NUM4,IFROM,ITO,II)         EQI01850
      IF(NUM4-3)85,20,20                                                EQI01860
C     IS EQUIPMENT CONNECTED TO A SYSTEM ALREADY                        EQI01870
   85 J=ISYSNO*100+ISITE2                                               EQI01880
      DO 86 I=1,21                                                      EQI01890
      IF((IGRC26(I)-(IGRC26(I)/100000)*100000)/100-J)86,87,86           EQI01900
   87 IF((IV26(I)-(IV26(I)/10000)*10000)/100-ISITE1)86,88,86            EQI01910
   88 WRITE(6,27)EQUIP(NUMB),VEHID(4),I                                 EQI01920
      GO TO 100                                                         EQI01930
   86 CONTINUE                                                          EQI01940
C     IS GRC-26 AVAILABLE AND OPERATIONAL?                              EQI01950
      IF((IGRC26(IVEHNO)-(IGRC26(IVEHNO)/100000)*100000)/100)89,89,71   EQI01960
   89 IF((IGRC26(IVEHNO)-(IGRC25(IVEHNO)/100)*100)/10)90,90,38          EQI01970
C     SCHEDULE INSTALLATION EVENT AND CHANGE GRC-26 UNIT TO REFLECT     EQI01980
C     INSTALLATION                                                      EQI01990
   90 IEVCAL(100)=33000+IVEHNO                                          EQI02000
      IGRC26(IVEHNO)=(IGRC26(IVEHNO)/10)*10+100*J+3                     EQI02010
   91 CALL GAUSS(IX,5.,15.,TIME1)                                       EQI02020
      IF(TIME1)91,78,78                                                 EQI02030
C                                                                       EQI02040
C                                                                       EQI02050
C     IS THERE AN EVENT IN FUTURE EVENTS TABLE CALLING FOR INSTALLATION EQI02060
C     OF EQUIPMENT ON SAME SYSTEM                                       EQI02070
    4 IEQTP=NUMB-3                                                      EQI02080
      IEQNO=IEVCUR-(IEVCUR/1000)*1000                                   EQI02090
C     GO TO EQUIPMENT TYPE                                              EQI02100
      GO TO(101,102,103),IEQTP                                          EQI02110
  101 IDUM4=IGRC50(IEQNO)                                               EQI02120
      GO TO 104                                                         EQI02130
  102 IDUM4=ITCC7(IEQNO)                                                EQI02140
      GO TO 104                                                         EQI02150
  103 IDUM4=IGRC26(IEQNO)                                               EQI02160
  104 IVEHTP=IDUM4/10000000                                             EQI02170
      IVEHNO=(IDUM4-(IDUM4/10000000)*10000000)/100000                   EQI02180
      ISYSNO=(IDUM4-(IDUM4/100000)*100000)/10000                        EQI02190
      ISITE1=(IDUM4-(IDUM4/10000)*10000)/100                            EQI02200
      ISYSTP=IDUM4-(IDUM4/10)*10                                        EQI02210
C     GO TO VEHICLE TYPE                                                EQI02220
      GO TO(105,106,107,108),IVEHTP                                     EQI02230
  105 ISITE2=(IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100            EQI02240
      NUM2=3                                                            EQI02250
      GO TO 109                                                         EQI02260
  106 ISITE2=(IM103(IVEHNO)-(IM103(IVEHNO)/10000)*10000)/100            EQI02270
      NUM2=1                                                            EQI02280
      GO TO 109                                                         EQI02290
  107 ISITE2=(IMCC6(IVEHNO)-(IMCC6(IVEHNO)/10000)*10000)/100            EQI02300
      NUM2=2                                                            EQI02310
      GO TO 109                                                         EQI02320
  108 ISITE2=(IV26(IVEHNO)-(IV26(IVEHNO)/10000)*10000)/100              EQI02330
      NUM2=4                                                            EQI02340
C     DETERMINE IF THERE EXISTS AN EVENT IN FUTURE EVENTS CALENDER      EQI02350
C     TO INSTALL EQUIPMENT ON SAME SYSTEM                               EQI02360
  109 CALL CKEVNT(ISITE1,ISITE2,ISYSTP,ISYSNO,IRESLT)                   EQI02370
C     WRITE MESSAGE                                                     EQI02380
      WRITE(6,111)EQUIP(IEQTP),VEHID(NUM2),IVEHNO,ISITE2,SYSTYP(ISYSTP),EQI02390
     1ISYSNO,ISITE1,ISITE2                                              EQI02400
  111 FORMAT(/17H INSTALLATION OF ,A8,3HIN ,A8,6HNUMBER,I3,8H AT SITE,  EQI02410
     1I3,3H ON,A4,10H SYSTEM NO,I2/10H FROM SITE,I3,8H TO SITE,I3,      EQI02420
     219H HAS BEEN COMPLETED)                                           EQI02430
      IF(IRESLT)110,110,100                                             EQI02440
C     WILL THIS EQUIPMENT MAKE THE SYSTEM OPERATIONAL?                  EQI02450
  110 GO TO(112,113,114),IEQTP                                          EQI02460
  112 CALL OP50(ISITE2,ISITE1,ISYSNO,IEQNO)                             EQI02470
      GO TO 100                                                         EQI02480
  113 CALL OP7(ISITE2,ISITE1,ISYSNO,ISYSTP,IEQNO)                       EQI02490
      GO TO 100                                                         EQI02500
  114 CALL OP26(ISITE2,ISITE1,ISYSNO)                                   EQI02510
C                                                                       EQI02520
  100 RETURN                                                            EQI02530
      END                                                               EQI02540


      SUBROUTINE CKEVNT(ISITE1,ISITE2,ISYSTP,ISYSNO,IRESLT)             CKE00010
C                                                                       CKE00020
C     THIS SUBROUTINE DETERMINES IF THERE IS ANY EVENT IN THE FUTURE    CKE00030
C     EVENTS TABLE CALLING FOR INSTALLATION OF EQUIPMENT ON THE SAME    CKE00040
C     SYSTEM AS THE ONE UNDER CONSIDERATION                             CKE00050
C                                                                       CKE00060
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      CKE00070
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),CKE00080
     2IDUM1(30),IGEN(54),LOCHQ(22)                                      CKE00090
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR                    CKE00100
C                                                                       CKE00110
      IRESLT=0                                                          CKE00120
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C     FIND SCHEDULED INSTALLATION EVENT IF ANY EXIST                    CKE00130
      DO 1 I=1,100                                                      CKE00140
C     DOES EVENT CALL FOR INSTALLATION?                                 CKE00150
      IF(IEVCAL(I)/10000-3)1,2,1                                        CKE00160
    2 IEQTP=(IEVCAL(I)-(IEVCAL(I)/10000)*10000)/1000                    CKE00170
      IEQNO=IEVCAL(I)-(IEVCAL(I)/1000)*1000                             CKE00180
C     GO TO EQUIPMENT TYPE                                              CKE00190
      GO TO(101,102,103),IEQTP                                          CKE00200
  101 IDUM4=IGRC50(IEQNO)                                               CKE00210
      GO TO 104                                                         CKE00220
  102 IDUM4=ITCC7(IEQNO)                                                CKE00230
      GO TO 104                                                         CKE00240
  103 IDUM4=IGRC26(IEQNO)                                               CKE00250
  104 IVEHTP=IDUM4/10000000                                             CKE00260
      IVEHNO=(IDUM4-(IDUM4/10000000)*10000000)/100000                   CKE00270
      ISYSNU=(IDUM4-(IDUM4/100000)*100000)/10000                        CKE00280
      IFROM=(IDUM4-(IDUM4/10000)*10000)/100                             CKE00290
      ISYSTY=IDUM4-(IDUM4/10)*10                                        CKE00300
C     GO TO VEHICLE TYPE                                                CKE00310
      GO TO(105,106,107,108),IVEHTP                                     CKE00320
  105 ITO=(IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100               CKE00330
      GO TO 109                                                         CKE00340
  106 ITO=(IM103(IVEHNO)-(IM103(IVEHNO)/10000)*10000)/100               CKE00350
      GO TO 109                                                         CKE00360
  107 ITO=(IMCC6(IVEHNO)-(IMCC6(IVEHNO)/10000)*10000)/100               CKE00370
      GO TO 109                                                         CKE00380
  108 ITO=(IV26(IVEHNO)-(IV26(IVEHNO)/10000)*10000)/100                 CKE00390
C     ARE SYSTEM TYPES THE SAME                                         CKE00400
  109 IF(ISYSTP-ISYSTY)1,110,1                                          CKE00410
C     ARE SYSTEM NUMBERS THE SAME?                                      CKE00420
  110 IF(ISYSNO-ISYSNU)1,111,1                                          CKE00430
C     ARE TO AND FROM SITES THE SAME?                                   CKE00440
  111 IF(IFROM-ISITE1)112,113,112                                       CKE00450
  112 IF(ITO-ISITE1)1,116,1                                             CKE00460
  116 IF(IFROM-ISITE2)1,115,1                                           CKE00470
  113 IF(ITO-ISITE2)1,115,1                                             CKE00480
C     EVENT HAS BEEN FOUND                                              CKE00490
  115 IRESLT=1                                                          CKE00500
      RETURN                                                            CKE00510
    1 CONTINUE                                                          CKE00520
C                                                                       CKE00530
      RETURN                                                            CKE00540
      END                                                               CKE00550
      SUBROUTINE SYSREM(ISYSTP)                                         SYS00010
C                                                                       SYS00020
C     THIS SUBROUTINE REMOVES A SYSTEM ON PLAYERS REQUEST. IF ANY       SYS00030
C     EQUIPMENT IS CURRENTLY ON THE SYSTEM IT IS REMOVED FROM IT.       SYS00040
      DOUBLE PRECISION VEHID,EQUIP                                      SYS00050
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      SYS00060
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),SYS00070
     2IDUM1(30),IGEN(54),LOCHQ(22)                                      SYS00080
      COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)            SYS00090
C                                                                       SYS00100
      NUM4=0                                                            SYS00110
      GO TO(1,2,3),ISYSTP                                               SYS00120
C                                                                       SYS00130
C     RR SYSTEM                                                         SYS00140
C     READ INPUT AND PRINT MESSAGE                                      SYS00150
    2 WRITE(6,4)SYSTYP(ISYSTP)                                          SYS00160
    4 FORMAT(/12H DISCONTINUE,A5,7H SYSTEM//13H FROM,TO, NUM/8H XX XX X SYS00170
     1)                                                                 SYS00180
      READ(5,5)ISITE1,ISITE2,ISYSNO                                     SYS00190
    5 FORMAT(I2,I3,I2)                                                  SYS00200
      WRITE(6,19)ISITE1,ISITE2,ISYSNO                                   SYS00210
   19 FORMAT(2I3,I2)                                                    SYS00220
      ITYPE=1                                                           SYS00230
C     DETERMINE IF SYSTEM EXISTS                                        SYS00240
      CALL SYSOP(IRRSYS,ISYSNO,ISITE1,ISITE2,NUM4,50,IFROM,ITO,II)      SYS00250
      IF(NUM4-3)6,7,6                                                   SYS00260
C     SYSTEM DOES NOT EXIST                                             SYS00270
    7 WRITE(6,8)                                                        SYS00280
    8 FORMAT(/22H SYSTEM DOES NOT EXIST)                                SYS00290
      GO TO 100                                                         SYS00300
C     REMOVE SYSTEM                                                     SYS00310
    6 IRRSYS(II)=0                                                      SYS00320
C     CHECK EACH GRC-50 TO DETERMINE IF IT IS ON SYSTEM                 SYS00330
      DO 9 I=1,140                                                      SYS00340
      ITO=(IGRC50(I)-(IGRC50(I)/10000)*10000)/100                       SYS00350
      IVEHNO=(IGRC50(I)-(IGRC50(I)/10000000)*10000000)/100000           SYS00360
      IVEHTP=IGRC50(I)/10000000                                         SYS00370
      IF(ITO-ISITE1)10,11,10                                            SYS00380
   10 IF(ITO-ISITE2)9,11,9                                              SYS00390
   11 GO TO(12,13),IVEHTP                                               SYS00400
   12 IFROM=(IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100             SYS00410
      NUM2=3                                                            SYS00420
      GO TO 14                                                          SYS00430
   13 IFROM=(IM103(IVEHNO)-(IM103(IVEHNO)/10000)*10000)/100             SYS00440
      NUM2=1                                                            SYS00450
   14 IF(IFROM-ISITE2)16,15,16                                          SYS00460
   16 IF(IFROM-ISITE1)9,15,9                                            SYS00470
   15 ISYSNU=(IGRC50(I)-(IGRC50(I)/100000)*100000)/10000                SYS00480
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      IF(ISYSNU-ISYSNO)9,17,9                                           SYS00490
C     REMOVE GRC-50 FROM SYSTEM                                         SYS00500
   17 IGRC50(I)=IGRC50(I)-(ISYSNO*100+ITO)*100                          SYS00510
C     PRINT MESSAGE                                                     SYS00520
      WRITE(6,22)EQUIP(ITYPE),VEHID(NUM2),IVEHNO,IFROM,SYSTYP(ISYSTP),  SYS00530
     1ISYSNO,ISITE1,ISITE2                                              SYS00540
   22 FORMAT(/A9,3HIN ,A8,6HNUMBER,I3,8H AT SITE,I3,22H HAS BEEN REMOVEDSYS00550
     1 FROM,A4/14H SYSTEM NUMBER,I2,10H FROM SITE,I3,8H TO SITE,I3,1H.) SYS00560
    9 CONTINUE                                                          SYS00570
      GO TO 23                                                          SYS00580
C                                                                       SYS00590
C     CBL SYSTEM                                                        SYS00600
C     WRITE MESSAGE AND RECEIVE INPUT                                   SYS00610
    1 WRITE(6,4)SYSTYP(ISYSTP)                                          SYS00620
      READ(5,5)ISITE1,ISITE2,ISYSNO                                     SYS00630
      WRITE(6,19)ISITE1,ISITE2,ISYSNO                                   SYS00640
C     DETERMINE IF SYSTEM EXISTS                                        SYS00650
      CALL SYSOP(ICBSYS,ISYSNO,ISITE1,ISITE2,NUM4,10,IFROM,ITO,II)      SYS00660
      IF(NUM4-3)45,7,45                                                 SYS00670
C     REMOVE SYSTEM                                                     SYS00680
   45 ICBSYS(II)=0                                                      SYS00690
C     CHECK EACH TCC-7 TO DETERMINE IF IT IS ON SYSTEM                  SYS00700
   23 ITYPE=2                                                           SYS00710
      DO 24 J=1,56                                                      SYS00720
      ITO=(ITCC7(J)-(ITCC7(J)/10000)*10000)/100                         SYS00730
      IVEHNO=(ITCC7(J)-(ITCC7(J)/10000000)*10000000)/100000             SYS00740
      IVEHTP=ITCC7(J)/10000000                                          SYS00750
      IF(ITO-ISITE1)25,26,25                                            SYS00760
   25 IF(ITO-ISITE2)24,26,24                                            SYS00770
   26 GO TO(28,29,29),IVEHTP                                            SYS00780
   28 IFROM=(IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100             SYS00790
      NUM2=3                                                            SYS00800
      GO TO 30                                                          SYS00810
   29 IFROM=(IMCC6(IVEHNO)-(IMCC6(IVEHNO)/10000)*10000)/100             SYS00820
      NUM2=2                                                            SYS00830
   30 IF(IFROM-ISITE2)32,31,32                                          SYS00840
   32 IF(IFROM-ISITE1)24,31,24                                          SYS00850
   31 ISYSNU=(ITCC7(J)-(ITCC7(J)/100000)*100000)/10000                  SYS00860
      IF(ISYSNU-ISYSNO)24,33,24                                         SYS00870
   33 IF(ITCC7(J)-(ITCC7(J)/10)*10-ISYSTP)24,34,24                      SYS00880
C     REMOVE TCC-7 FROM SYSTEM                                          SYS00890
   34 ITCC7(J)=ITCC7(J)-(ISYSNO*100+ITO)*100                            SYS00900
      WRITE(6,22)EQUIP(ITYPE),VEHID(NUM2),IVEHNO,IFROM,SYSTYP(ISYSTP),  SYS00910
     1ISYSNO,ISITE1,ISITE2                                              SYS00920
   24 CONTINUE                                                          SYS00930
   47 WRITE(6,46)SYSTYP(ISYSTP),ISYSNO,ISITE1,ISITE2                    SYS00940
   46 FORMAT(/A5,14H SYSTEM NUMBER,I2,10H FROM SITE,I3,8H TO SITE,I3,   SYS00950
     118H HAS BEEN REMOVED.)                                            SYS00960
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      GO TO 100                                                         SYS00970
C                                                                       SYS00980
C     H-F SYSTEM                                                        SYS00990
C     WRITE MESSAGE AND RECEIVE INPUT                                   SYS01000
    3 WRITE(6,4)SYSTYP(ISYSTP)                                          SYS01010
      READ(5,5)ISITE1,ISITE2,ISYSNO                                     SYS01020
      WRITE(6,19)ISITE1,ISITE2,ISYSNO                                   SYS01030
      ITYPE=3                                                           SYS01040
C     DETERMINE IF SYSTEM EXISTS                                        SYS01050
      CALL SYSOP(IHFSYS,ISYSNO,ISITE1,ISITE2,NUM4,20,IFROM,ITO,II)      SYS01060
      IF(NUM4-3)35,7,35                                                 SYS01070
C     REMOVE SYSTEM                                                     SYS01080
   35 IHFSYS(II)=0                                                      SYS01090
C     CHECK EACH GRC-26 TO DETERMINE IF IT IS ON SYSTEM                 SYS01100
      DO 36 I=1,21                                                      SYS01110
      ITO=(IGRC26(I)-(IGRC26(I)/10000)*10000)/100                       SYS01120
      IF(ITO-ISITE1)37,38,37                                            SYS01130
   37 IF(ITO-ISITE2)36,38,36                                            SYS01140
   38 IFROM=(IV26(I)-(IV26(I)/10000)*10000)/100                         SYS01150
      NUM2=4                                                            SYS01160
      IF(IFROM-ISITE2)39,40,39                                          SYS01170
   39 IF(IFROM-ISITE1)36,40,36                                          SYS01180
   40 ISYSNU=(IGRC26(I)-(IGRC26(I)/100000)*100000)/10000                SYS01190
      IF(ISYSNU-ISYSNO)36,41,36                                         SYS01200
C     REMOVE GRC-26 FROM SYSTEM                                         SYS01210
   41 IGRC26(I)=IGRC26(I)-(ISYSNO*100+ITO)*100                          SYS01220
      WRITE(6,22)EQUIP(ITYPE),VEHID(NUM2),IVEHNO,IFROM,SYSTYP(ISYSTP),  SYS01230
     1ISYSNO,ISITE1,ISITE2                                              SYS01240
   36 CONTINUE                                                          SYS01250
      GO TO 47                                                          SYS01260
C                                                                       SYS01270
  100 RETURN                                                            SYS01280
      END                                                               SYS01290


      SUBROUTINE SYINST(ISYSTP)                                         SYI00010
C                                                                       SYI00020
C     THIS SUBROUTINE INSTALLS A SYSTEM ON PLAYERS REQUEST              SYI00030
      DOUBLE PRECISION VEHID,EQUIP                                      SYI00040
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      SYI00050
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),SYI00060
     2IDUM1(30),IGEN(54),LOCHQ(22)                                      SYI00070
      COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)            SYI00080
C                                                                       SYI00090
      NUM4=0                                                            SYI00100
C     PRINT MESSAGE AND RECEIVE INPUT                                   SYI00110
      WRITE(6,4)SYSTYP(ISYSTP)                                          SYI00120
    4 FORMAT(/9H INSTALL ,A4,6HSYSTEM//17H FROM, TO, NUMBER/8H XX XX X) SYI00130
```

```
      READ(5,5)IFROM,ITO,ISYSNO
    5 FORMAT(I2,I3,I2)
      WRITE(6,6)IFROM,ITO,ISYSNO
    6 FORMAT(2I3,I2)
C     GO TO SYSTEM TYPE
      GO TO(1,2,3),ISYSTP
C
C     CBL SYSTEM
C     DOES SYSTEM ALREADY EXIST?
    1 CALL SYSOP(ICBSYS,ISYSNO,OFROM,ITO,NUM4,10,K,KK,II)
      IF(NUM4-3)7,8,7
C     SYSTEM ALREADY EXISTS
    7 WRITE(6,9)
    9 FORMAT(/22H SYSTEM ALREADY EXISTS)
      GO TO 100
C     FIND FIRST CBL SYSTEM UNIT IN ARRAY NOT BEING USED
    8 DO 10 I=1,10
      IF(ICBSYS(I))10,11,10
   10 CONTINUE
   15 WRITE(6,12)SYSTYP(ISYSTP)
   12 FORMAT(/25H GAME CANNOT ACCEPT MORE ,A4,7HSYSTEMS)
      GO TO 100
   11 ICBSYS(I)=ISYSNO*100000+IFROM*1000+ITO*10+1
   13 WRITE(6,14)SYSTYP(ISYSTP),ISYSNO,IFROM,ITO
   14 FORMAT(/A5,13HSYSTEM NUMBER,I2,10H FROM SITE,I3,8H TO SITE,I3,
     110H HAS BEEN /29H INSTALLED (NON-OPERATIONAL).)
      GO TO 100
C
C     RR SYSTEM
    2 CALL SYSOP(IRRSYS,ISYSNO,IFROM,ITO,NUM4,50,K,KK,II)
      IF(NUM4-3)7,16,7
   16 DO 17 I=1,50
      IF(IRRSYS(I))17,18,17
   17 CONTINUE
      GO TO 15
   18 IRRSYS(I)=ISYSNO*100000+IFROM*1000+ITO*10+1
      GO TO 13
C
C     HF SYSTEM
    3 CALL SYSOP(IHFSYS,ISYSNO,IFROM,ITO,NUM4,20,K,KK,II)
      IF(NUM4-3)7,19,7
   19 DO 20 I=1,20
      IF(IHFSYS(I))20,21,20
   20 CONTINUE
      GO TO 15
   21 IHFSYS(I)=ISYSNO*100000+IFROM*1000+ITO*10+1
      GO TO 13
C
```

```
  100 RETURN                                                            SYI00620
      END                                                               SYI00630

      SUBROUTINE VEHMOV(IVEHTP)                                         VEH00010
C                                                                       VEH00020
C     THIS SUBROUTINE PROCESSES THE MOVING AND ARRIVAL OF COMMUNICATIONSVEH00030
C     VEHICLES                                                          VEH00040
C                                                                       VEH00050
      DOUBLE PRECISION VEHID,EQUIP                                      VEH00060
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),      VEH00070
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),VEH00080
                                                                        VEH00090
     2IDUM1(30),IGEN(54),LOCHQ(22)                                      VEH00100
      COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)            VEH00110
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR                    VEH00120
      COMMON/C6/IX                                                      VEH00130
C                                                                       VEH00140
C     GO TO MOVEMENT OR ARRIVAL SECTION                                 VEH00150
      IF(IVEHTP-5)1,1,2                                                 VEH00160
    1 IF(IVEHTP-5)70,60,60                                              VEH00170
   60 WRITE(6,61)                                                       VEH00180
   61 FORMAT(/15H MOVE GENERATOR//34H VEH NUMBER, AT SITE, MOVE TO SITE/VEH00190
     19H XX XX XX)                                                      VEH00200
      GO TO 62                                                          VEH00210
C     MOVEMENT                                                          VEH00220
C     PRINT MESSAGE AND RECEIVE INPUT                                   VEH00230
   70 WRITE(6,3)VEHID(IVEHTP)                                           VEH00240
    3 FORMAT(/5H MOVE,A9//34H VEH NUMBER, AT SITE, MOVE TO SITE/        VEH00250
     19H XX XX XX)                                                      VEH00260
   62 READ(5,4)IVEHNO,IFROM,ITO                                         VEH00270
    4 FORMAT(I2,2I3)                                                    VEH00280
      WRITE(6,5)IVEHNO,IFROM,ITO                                        VEH00290
    5 FORMAT(3I3)                                                       VEH00300
C     GO TO VEHICLE TYPE                                                VEH00310
      GO TO (6,7,8,9,10),IVEHTP                                         VEH00320
    6 IV=IM103(IVEHNO)                                                  VEH00330
      GO TO 11                                                          VEH00340
    7 IV=IMCC6(IVEHNO)                                                  VEH00350
      GO TO 11                                                          VEH00360
    8 IV=IM102(IVEHNO)                                                  VEH00370
      GO TO 11                                                          VEH00380
    9 IV=IV26(IVEHNO)                                                   VEH00390
      GO TO 11                                                          VEH00400
   10 IV=IGEN(IVEHNO)                                                   VEH00410
C     IS VEHICLE AT SITE?                                               VEH00420
   11 IF((IV-(IV/10000)*10000)/100-IFROM)12,64,12                       VEH00430
   12 WRITE(6,20)IVEHNO,IFROM                                           VEH00440
   20 FORMAT(/15H VEHICLE NUMBER,I3,23H IS NOT LOCATED AT SITE,I3)      VEH00450
      GO TO 100                                                         VEH00460
C     IS VEHICLE OPERATIONAL?                                           VEH00470
   64 IF((IV-(IV/100)*100)/10)13,13,65                                  VEH00480
   65 WRITE(6,66)IVEHNO                                                 VEH00490
   66 FORMAT(/15H VEHICLE NUMBER,I3,14H IS DEADLINED.)                  VEH00500
      GO TO 100                                                         VEH00510
C     IS VEHICLE IN TRANSIT?                                            VEH00520
   13 IF(IV-(IV/10)*10)14,14,80                                         VEH00530
   80 WRITE(6,21)IVEHNO                                                 VEH00540
   21 FORMAT(/15H VEHICLE NUMBER,I3,39H IS IN TRANSIT AND CANNOT BE CONTVEH00550
     1ACTED.)                                                           VEH00560
      GO TO 100                                                         VEH00570
C     DOES TO SITE EXIST?                                               VEH00580
   14 IF(LOCSIT(ITO))15,15,16                                           VEH00590
   15 WRITE(6,22)ITO                                                    VEH00600
   22 FORMAT(/12H SITE NUMBER,I3,15H DOES NOT EXIST)                    VEH00610
      GO TO 100                                                         VEH00620
C     IS ALL EQUIPMENT FREE?                                            VEH00630
   16 GO TO(23,24,25,26,40),IVEHTP                                      VEH00640
C     MRC-103                                                           VEH00650
   23 IBOT=IVEHNO*3+42                                                  VEH00660
      ITOP=IBOT+2                                                       VEH00670
      DO 28 I=IBOT,ITOP                                                 VEH00680
      IF((IGRC50(I)-(IGRC50(I)/100000)*100000)/100)29,28,29             VEH00690
   28 CONTINUE                                                          VEH00700
      GO TO 40                                                          VEH00710
   29 WRITE(6,30)VEHID(IVEHTP),IVEHNO                                   VEH00720
   30 FORMAT(/A9,6HNUMBER,I3,30H STILL HAS CONNECTED EQUIPMENT)         VEH00730
      GO TO 100                                                         VEH00740
C     MCC-6                                                             VEH00750
   24 IBOT=IVEANO*2+21                                                  VEH00760
      ITOP=IBOT+1                                                       VEH00770
      DO 31 I=IBOT,ITOP                                                 VEH00780
      IF((ITCC7(I)-(ITCC7(I)/100000)*100000)/100)29,31,29               VEH00790
   31 CONTINUE                                                          VEH00800
      GO TO 40                                                          VEH00810
C     MRC - 102                                                         VEH00820
   25 IBOT=IVEHNO*2-1                                                   VEH00830
      ITOP=IBOT+1                                                       VEH00840
      DO 32 I=IBOT,ITOP                                                 VEH00850
      IF((IGRC50(I)-(IGRC50(I)/100000)*100000)/100)29,32,29             VEH00860
   32 CONTINUE                                                          VEH00870
      IF((ITCC7(IVEHNO)-(ITCC7(IVEHNO)/100000)*100000)/100)29,40,29     VEH00880
C     GRC-26                                                            VEH00890
   26 IF((IGRC26(IVEHNO)-(IGRC26(IVEHNO)/100000)*100000)/100)29,40,29   VEH00900
C     CALCULATE DISATNCE TO 'TO' SITE (PLUS 25 PERCENT)                 VEH00910
   40 XDIST=(LOCSIT(IFROM)-(LOCSIT(IFROM)/1000000)*1000000)/1000-       VEH00920
```

```
     1(LOCSIT(ITO)-(LOCSIT(ITO)/1000000)*1000000)/1000                  VEH00930
      YDIST=(LOCSIT(IFROM)-(LOCSIT(IFROM)/1000)*1000)-(LOCSIT(ITO)-     VEH00940
     1(LOCSIT(ITO)/1000)*1000)                                          VEH00950
      IDIST=SQRT(XDIST**2+YDIST**2)*(1.25/10.)                          VEH00960
C     WILLVEHICLE BREAKDOWN?                                            VEH00970
      IF(IV/10000-IDIST)41,41,42                                        VEH00980
C     VEHICLE BREAKS DOWN                                               VEH00990
C     CALCULATE TIME OF BREAKDOWN (18 KM/HR)                            VEH01000
   41 TIME1=(IDIST-IV/10000)*(60./18.)                                  VEH01010
  101 CALL GAUSS(IX,TIME1/3.,TIME1,FAIL)                                VEH01020
      IF(FAIL)101,102,102                                               VEH01030
  102 IFAIL=FAIL                                                        VEH01040
C     SCHEDULE BREAKDOWN EVENT                                          VEH01050
      IEVCAL(100)=50000+IVEHTP*1000+IVEHNO                              VEH01060
      JEVCAL(100)=ITIME+IFAIL                                           VEH01070
      CALL ORDERT                                                       VEH01080
C     STORE DISTANCE REMAINING TO DESTINATION AND CHANGE TRANSIT FLAG   VEH01090
      IDUM2=IV-(IV/10000)*10000+(IDIST-IV/10000)*10000+1                VEH01100
C     CHANGE LOCATION                                                   VEH01110
      IDUM2=IDUM2-IFROM*100+ITO*100                                     VEH01120
   49 GO TO (43,44,45,46,47),IVEHTP                                     VEH01130
   43 IM103(IVEHNO)=IDUM2                                               VEH01140
      GO TO 48                                                          VEH01150
   44 IMCC6(IVEHNO)=IDUM2                                               VEH01160
      GO TO 49                                                          VEH01170
   45 IM102(IVEHNO)=IDUM2                                               VEH01180
      GO TO 48                                                          VEH01190
   46 IV26(IVEHNO)=IDUM2                                                VEH01200
      GO TO 48                                                          VEH01210
   47 IGEN(IVEHNO)=IDUM2                                                VEH01220
      GO TO 48                                                          VEH01230
C     NO VEHICLE BREAKDOWN - SCHEDULE ARRIVAL EVENT                     VEH01240
   42 TIME1=IDIST*60./18.                                               VEH01250
  103 CALL GAUSS(IX,TIME1/3.,TIME1,ARRIV)                               VEH01260
      IF(ARRIV)103,104,104                                              VEH01270
  104 IARRIV=ARRIV                                                      VEH01280
      IEVCAL(100)=40000+IVEHTP*1000+IVEHNO                              VEH01290
      JEVCAL(100)=ITIME+IARRIV                                          VEH01300
      CALL ORDERT                                                       VEH01310
C     SUBTRACT DISTANCE TRAVELED FROM NEXT BREAKDOWN DISTANCE AND CHANGEVEH01320
C     TRANSIT FLAG                                                      VEH01330
      IDUM2=IV-IDIST*10000+1                                            VEH01340
C     CHANGE LOCATION                                                   VEH01350
      IDUM2=IDUM2-IFROM*100+ITO*100                                     VEH01360
      GO TO 49                                                          VEH01370
C     PRINT MESSAGE                                                     VEH01380
   48 WRITE(6,50)IVEHNO,IFROM,ITO                                       VEH01390
   50 FORMAT(/15H VEHICLE NUMBER,I3,14H HAS LEFT SITE,I3,26H AND IS PROCVEH01400
     1EEDING TO SITE,I3)
      GO TO 100
C
C
C     ARRIVAL
    2 IVEHTP=IVEHTP-5
      IVEHNO=IEVCUR-(IEVCUR/1000)*1000
C     CHANGE TRANSIT FLAG AND DETERMINE SITE
      GO TO(51,52,53,54,55),IVEHTP
   51 IM103(IVEHNO)=IM103(IVEHNO)-1
      ISITE=(IM103(IVEHNO)-(IM103(IVEHNO)/10000)*10000)/100
      GO TO 56
   52 IMCC6(IVEHNO)=IMCC6(IVEHNO)-1
      ISITE=(IMCC6(IVEHNO)-(IMCC6(IVEHNO)/10000)*10000)/100
      GO TO 56
   53 IM102(IVEHNO)=IM102(IVEHNO)-1
      ISITE=(IM102(IVEHNO)-(IM102(IVEHNO)/10000)*10000)/100
      GO TO 56
   54 IV26(IVEHNO)=IV26(IVEHNO)-1
      ISITE=(IV26(IVEHNO)-(IV26(IVEHNO)/10000)*10000)/100
      GO TO 56
   55 IGEN(IVEHNO)=IGEN(IVEHNO)-1
      ISITE=(IGEN(IVEHNO)-(IGEN(IVEHNO)/10000)*10000)/100
      WRITE(6,63)IVEHNO,ISITE
   63 FORMAT(/17H GENERATOR NUMBER,I3,20H HAS ARRIVED AT SITE,I3)
      GO TO 100
C     PRINT MESSAGE
   56 WRITE(6,57)VEHID(IVEHTP),IVEHNO,ISITE
   57 FORMAT(/A9,6HNUMBER,I3,20H HAS ARRIVED AT SITE,I3)
C
  100 RETURN
      END


      SUBROUTINE RANDU(IX,IY,YFL)
C
C        PURPOSE
C           COMPUTES UNIFORMLY DISTRIBUTED RANDOM REAL NUMBERS BETWEEN
C           0 AND 1.0 AND RANDOM INTEGERS BETWEEN ZERO AND
C           2**31. EACH ENTRY USES AS INPUT AN INTEGER RANDOM NUMBER
C           AND PRODUCES A NEW INTEGER AND REAL RANDOM NUMBER.
C
C        DESCRIPTION OF PARAMETERS
C           IX - FOR THE FIRST ENTRY THIS MUST CONTAIN ANY ODD INTEGER
C                NUMBER WITH NINE OR LESS DIGITS. AFTER THE FIRST ENTRY,
C                IX SHOULD BE THE PREVIOUS VALUE OF IY COMPUTED BY THIS
C                SUBROUTINE.
C           IY - A RESULTANT INTEGER RANDOM NUMBER REQUIRED FOR THE NEXT
```

```
C                ENTRY TO THIS SUBROUTINE. THE RANGE OF THIS NUMBER IS
C                BETWEEN ZERO AND 2**31
C           YFL- THE RESULTANT UNIFORMLY DISTRIBUTED, FLOATING POINT,
C                RANDOM NUMBER IN THE RANGE 0 TO 1.0
C
      IY=IX*65539
      IF(IY)5,6,6
    5 IY=IY+2147483647+1
    6 YFL=IY
      YFL=YFL*.4656613E-9
      RETURN
      END


      SUBROUTINE GAUSS(IX,S,AM,V)
C
C
C        PURPOSE
C           COMPUTES A NORMALLY DISTRIBUTED RANDOM NUMBER WITH A GIVEN
C           MEAN AND STANDARD DEVIATION
C
C        DESCRIPTION OF PARAMETERS
C           IX -IX MUST CONTAIN AN ODD INTEGER NUMBER WITH NINE OR
C               LESS DIGITS ON THE FIRST ENTRY TO GAUSS. THEREAFTER
C               IT WILL CONTAIN A UNIFORMLY DISTRIBUTED INTEGER RANDOM
C               NUMBER GENERATED BY THE SUBROUTINE FOR USE ON THE NEXT
C               ENTRY TO THE SUBROUTINE.
C           S  -THE DESIRED STANDARD DEVIATION OF THE NORMAL
C               DISTRIBUTION.
C           AM -THE DESIRED MEAN OF THE NORMAL DISTRIBUTION
C           V  -THE VALUE OF THE COMPUTED NORMAL RANDOM VARIABLE
C
      A=0.0
      DO 50 I=1,12
      CALL RANDU(IX,IY,Y)
      IX=IY
   50 A=A+Y
      V=(A-6.0)*S+AM
      RETURN
      END


      SUBROUTINE ORDERT
C
C     THIS SUBROUTINE ORDERS THE EVENTS IN THE FUTURE EVENTS TABLE
C     BY TIME
C
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR
```

```
C                                                                       ORD00070
C     DETERMINE NUMBER OF EVENTS IN TABLE                               ORD00080
      DO 1 J=1,100                                                      ORD00090
      IF(IEVCAL(J))2,2,1                                                ORD00100
    1 CONTINUE                                                          ORD00110
    2 IF(IEVCAL(100))3,3,4                                              ORD00120
    4 IEVCAL(J)=IEVCAL(100)                                             ORD00130
      JEVCAL(J)=JEVCAL(100)                                             ORD00140
      IEVCAL(100)=0                                                     ORD00150
      JEVCAL(100)=0                                                     ORD00160
      GO TO 5                                                           ORD00170
    3 J=J-1                                                             ORD00180
C     SET INDEX OF ENTRY IN TABLE, DEFINE DUMMIES, AND BEGIN MAIN LOOP  ORD00190
    5 IBOT=1                                                            ORD00200
      ITOP=J-1                                                          ORD00210
      DO 8 K=1,ITOP                                                     ORD00220
      IBOT=IBOT+1                                                       ORD00230
      IDUM=IEVCAL(IBOT-1)                                               ORD00240
      JDUM=JEVCAL(IBOT-1)                                               ORD00250
C     CHECK EACH REMAINING ENTRY IN ARRAY AND REPLACE DUMMY IF ENTRY    ORD00260
C     IS SMALLER                                                        ORD00270
      DO 9 I=IBOT,J                                                     ORD00280
      IF(JEVCAL(I).GE.JDUM)GO TO 9                                      ORD00290
      JEVCAL(IBOT-1)=JEVCAL(I)                                          ORD00300
      IEVCAL(IBOT-1)=IEVCAL(I)                                          ORD00310
      JEVCAL(I)=JDUM                                                    ORD00320
      IEVCAL(I)=IDUM                                                    ORD00330
      JDUM=JEVCAL(IBOT-1)                                               ORD00340
      IDUM=IEVCAL(IBOT-1)                                               ORD00350
    9 CONTINUE                                                          ORD00360
    8 CONTINUE                                                          ORD00370
C                                                                       ORD00380
      RETURN                                                            ORD00390
      END                                                               ORD00400


      SUBROUTINE TIME(ITIME,IDAY)
C
C     THIS SUBROUTINE CONVERTS TIME IN SECONDS WHICH IS USED INTERNALLY
C     TO TIME IN DAYS, HOURS, AND MINUTES FOR PLAYER USE
C
      IHOUR=0
      IF(ITIME.LT.IDAY*1440)GO TO 6
      IDAY=IDAY+1
    6 IMIN=ITIME-(IDAY-1)*1440
    9 IF(IMIN.LT.(IHOUR+1)*60)GO TO 8
      IHOUR=IHOUR+1
      GO TO 9
    8 IMIN=IMIN-IHOUR*60
      IMIN1=IMIN/10
      IMIN2=IMIN-(IMIN/10)*10
      IHOUR1=IHOUR/10
      IHOUR2=IHOUR-(IHOUR/10)*10
C     WRITE DAY AND TIME
      WRITE(6,10)IDAY,IHOUR1,IHOUR2,IMIN1,IMIN2
   10 FORMAT(/' DAY',I3,4X,4I1)
C
      RETURN
      END


      BLOCK DATA
C
C     THIS SUBROUTINE INITIALIZES ARRAYS
C
      DOUBLE PRECISION VEHID,EQUIP
      COMMON/C1/LOCSIT(30),IM102(22),IM103(32),IMCC6(17),IV26(21),
     1IGRC50(140),ITCC7(56),IGRC26(21),IRRSYS(50),IHFSYS(20),ICBSYS(10),
     1IDUM1(30),IGEN(54),LOCHQ(22)
      COMMON/C2/VEHID(5),EQUIP(3),SYSTYP(3),STATUS(2),HQ(69)
      COMMON/C5/IEVCAL(100),JEVCAL(100),ITIME,IEVCUR
      COMMON/C4/IG50FL(140),IT7FL(56),IG26FL(21),IGENFL(54),ISITFL(30)
C
      REAL*8 VEHID/'MRC-103 ','MCC-6   ','MRC-102 ','GRC-26  ','
     1'/,EQUIP/'GRC-50  ','TCC-7   ','GRC-26  '/, STATUS*4/'YES ',
     2' NO '/,SYSTYP*4/'CBL ',' RR ','H-F '/,HQ*4/'CORP','S MA','IN  ',
     3'CORP','S AL','T   ','CORP','S AR','TY  ','21 D','IV M','AIN ',
     4'21 D','IV A','LT  ','52 D','IV M','AIN ','52 D','IV A','LT  ',
     5'53 D','IV M','AIN ','53 D','IV A','LT  ','25 D','IV M','AIN ',
     6'ARM ','CAV ','REG ','312 ','MECH',' BDE','101 ','AVN ','REG ',
     7'61 A','RTY ','GP  ','62 A','RTY ','GP  ','63 A','RTY ','GP  ',
     8'TGT ','ACQ ','BN  ','SGT ','MSL ','BN  ','MON ','710 ','AASC',
     9'MON ','715 ','AASC','51 E','NG B','DE  ','64 A','RTY ','GP  ',
     A'RELA','Y SI','TE  '/
      INTEGER LOCSIT/30*0/,IM102/22*0/,IM103/32*0/,IMCC6/17*0/,
     1IV26/21*0/,IRRSYS/50*0/,IHFSYS/20*0/,ICBSYS/10*0/,IGEN/54*0/
     2,LOCHQ/284501,645591,459460,729661,736608,765517,811472,696374,
     3825351,352392,868354,271470,600411,721702,784555,834402,595513,
     4274658,520730,492460,437389,837455/,IEVCAL/100*0/,JEVCAL/100*0/
     5,IG50FL/140*0/,IT7FL/56*0/,IG26FL/21*0/,IGENFL/54*0/,ISITFL/30*0/
C
      END
```

SAMPLE TERMINAL PRINTOUT

The following pages provide an illustration of the general format of the printout at the remote terminal. The sample game segment shown used punched cards for input with the master and generator tables printed offline.

```
INPUT GAMEWORD
XX
11

INPUT ODD RANDUM NUMBER
XXXXXXX
1111111

INPUT IS ENTERED BY CARDS

COMPLETE SYSTEM AND GENERATOR TABLES ARE PRINTED BY HIGH SPEED PRINTER


EQUIPMENT FAILURE
    AN/GRC-50 RADIO IN MRC-103  NUMBER 19 LOCATED AT CORPS ARTY   (SITE  3)
    FAILED. RADIO WAS OPERATING ON SYSTEM NUMBER  1 FROM CORPS ARTY   (SITE  3)
    TO 61 ARTY GP   (SITE 14)

    ESTIMATED REPAIR TIME IS  1 HOURS  7 MIN.

DAY  1    0002

ENTER DECISION
XXX
201
201



REMOVE GRC-50  FROM SYSTEM

SITE NO, SYSTEM NO, TO SITE
XX X XX
 3 1 14
 3 1 14

GRC-50  IN MRC-103 NUMBER 19 AT SITE  3 HAS BEEN REMOVED FROM RR
SYSTEM NUMBER 1 FROM SITE  3 TO SITE 14.

DAY  1    0002

ENTER DECISION
XXX
301
301



INSTALL GRC-50   ON SYSTEM

SITE NO, VEH TYPE (1=MRC-103, 2=MRC-102), VEH NO, SYSTEM NO, TO SITE
XX X XX X XX
 3 1 24 1 14
 3 1 24 1 14

INSTALLATION OF GRC-50  IN MRC-103 NO 24 LOCATED AT SITE  3
HAS BEGUN.  RR  SYSTEM IS FROM SITE  3 TO SITE 14.

DAY  1    0002

ENTER DECISION
XXX
000
```

```
  0


INSTALLATION OF GRC-50  IN MRC-103 NUMBER 24 AT SITE  3 ON RR  SYSTEM NO 1
FROM SITE 14 TO SITE  3 HAS BEEN COMPLETED

RADIO RELAY SYSTEM NUMBER 1 FROM SITE  3 TO SITE 14 IS NOW OPERATING.

DAY  1    0015

ENTER DECISION
XXX
000
  0


DAY  1    0045

ENTER DECISION
XXX
000
  0


DAY  1    0115

ENTER DECISION
XXX
000
```

```
  0


EQUIPMENT REPAIR
    AN/GRC-50 RADIO IN MRC-103  NUMBER 19 LOCATED AT CORPS ARTY   (SITE  3)
    HAS BEEN REPAIRED.

DAY  1    0133

ENTER DECISION
XXX
402
402



DISCONTINUE  RR  SYSTEM

FROM,TO, NUM
XX XX X
 1  2 1
 1  2 1

GRC-50  IN MRC-103 NUMBER  5 AT SITE  1 HAS BEEN REMOVED FROM RR
SYSTEM NUMBER 1 FROM SITE  1·TO SITE  2.

GRC-50  IN MRC-103 NUMBER 11 AT SITE  2 HAS BEEN REMOVED FROM RR
SYSTEM NUMBER 1 FROM SITE  1 TO SITE  2.

TCC-7   IN MCC-6   NUMBER  5 AT SITE  1 HAS BEEN REMOVED FROM RR
SYSTEM NUMBER 1 FROM SITE  1 TO SITE  2.
```

```
TCC-7    IN MCC-6    NUMBER   9 AT SITE   2 HAS BEEN REMOVED FROM RR
SYSTEM NUMBER 1 FROM SITE   1 TO SITE   2.

 RR  SYSTEM NUMBER 1 FROM SITE   1 TO SITE   2 HAS BEEN REMOVED.

DAY  1    0133

ENTER DECISION
XXX
000
  0



DAY  1    0203

ENTER DECISION
XXX
000
  0



DAY  1    0233

ENTER DECISION
XXX
000
  0



EQUIPMENT FAILURE
    GENERATOR NUMBER  8 LOCATED AT CORPS MAIN   (SITE  1) FAILED.
    ESTIMATED REPAIR TIME IS  7 HOURS 55 MIN.

DAY  1    0243

ENTER DECISION
XXX
000
  0



DAY  1    0313

ENTER DECISION
XXX
000
  0



EQUIPMENT FAILURE
    AN/GRC-50 RADIO IN MRC-103  NUMBER  1 LOCATED AT CORPS MAIN   (SITE  1)
    FAILED. RADIO WAS OPERATING ON SYSTEM NUMBER  1 FROM CORPS MAIN   (SITE  1)
    TO RELAY SITE   (SITE 23)

    ESTIMATED REPAIR TIME IS  5 HOURS 28 MIN.

DAY  1    0340

ENTER DECISION
XXX
101
```

```
                *       VEHICLES       *           SYSTEMS            *
                *                      *                              *
SITE  LOCATION  *  TYPE     NUM  OPER  * FROM  TO  NUM  TYPE   OPER  * DEADLINED EQUIP
*************************************************************************************
  1    284501   *                      *                              *
CORPS MAIN      *                      *                              *
                * MRC-103    1   YES   *   1   23   1    RR      NO  * GRC-50
                *                      *   1   23   2    RR     YES  *
                * MRC-103    2   YES   *   1   23   3    RR     YES  *
                *                      *   1   23   4    RR     YES  *
                * MRC-103    3   YES   *   1   24   1    RR     YES  *
                *                      *   1   24   2    RR     YES  *
                * MRC-103    4   YES   *   1   24   3    RR     YES  *
                *                      *   1   10   1    RR     YES  *
                * MRC-103    5   YES   *   1   10   2    RR     YES  *
                * MRC-103    6   YES   *   1    2   2    RR     YES  *
                *                      *   1    3   1    RR     YES  *
                * MRC-103    7   YES   *   1    3   2    RR     YES  *
                *                      *   1   13   1    RR     YES  *
                * MRC-103    8   YES   *                              *
                * MRC-103    9   YES   *                              *
                * MRC-103   10   YES   *                              *
                * MCC-6      1   YES   *   1   23   1    RR      NO  *
                *                      *   1   23   2    RR     YES  *
                * MCC-6      2   YES   *   1   23   3    RR     YES  *
                *                      *   1   23   4    RR     YES  *
                * MCC-6      3   YES   *   1   24   1    RR     YES  *
                *                      *   1   24   2    RR     YES  *
                * MCC-6      4   YES   *   1   24   3    RR     YES  *
                *                      *   1   10   1    RR     YES  *
```

```
               * MCC-6     5   YES  *   1  10   2    RR    YES *
               * MCC-6     6   YES  *   1   2   2    RR    YES *
               *                    *   1   3   1    RR    YES *
               * MCC-6     7   YES  *   1   3   2    RR    YES *
               *                    *   1  13   1    RR    YES *
               * MCC-6     8   YES  *                          *
               * MRC-102   1   YES  *                          *
DAY  1    0340

ENTER DECISION
XXX
601
601


MOVE MRC-103

VEH NUMBER, AT SITE, MOVE TO SITE
XX XX XX
 9  1 23
 9  1 23

VEHICLE NUMBER  9 HAS LEFT SITE  1 AND IS PROCEEDING TO SITE 23

DAY  1    0340

ENTER DECISION
XXX
000
```

```
  0


DAY  1    0410

ENTER DECISION
XXX
000
  0


DAY  1    0440

ENTER DECISION
XXX
000
  0


MRC-103 NUMBER  9 HAS ARRIVED AT SITE 23

DAY  1    0503

ENTER DECISION
XXX
000
  0


EQUIPMENT FAILURE
    AN/TCC-7 MULTIPLEX IN MCC-6    NUMBER 10 LOCATED AT CORPS ALT   (SITE  2)
    FAILED. MULTIPLEX WAS OPERATING ON  RR SYSTEM NUMBER  1 FROM CORPS ALT    (SITE  2)
    TO 21 DIV ALT   (SITE  5)

    ESTIMATED REPAIR TIME IS  1 HOURS 36 MIN.

DAY  1    0516

ENTER DECISION
XXX
202
202



REMOVE TCC-7 FROM SYSTEM
SITE NO, SYSTEM NO, TO SITE, SYSTEM TYPE (1 = CBL, 2 = RR)
XX X XX X
 2 1  5 2
 2 1  5 2

TCC-7   IN MCC-6   NUMBER 10 AT SITE  2 HAS BEEN REMOVED FROM RR
SYSTEM NUMBER 1 FROM SITE  2 TO SITE  5.

DAY  1    0516

ENTER DECISION
XXX
302
302


INSTALL TCC-7 ON SYSTEM

SITE NO, VEH TYPE (1=MRC-102, 2=MCC-6), VEH NO, SYSTEM NO, TO SITE, SYS TYPE (1=CBL, 2=RR)
```

```
XX X XX X XX X
 2 2 12 1  5 2
 2 2 12 1  5 2

INSTALLATION OF TCC-7   IN MCC-6   NO 12 LOCATED AT SITE  2
HAS BEGUN.  RR  SYSTEM IS FROM SITE  2 TO SITE  5.

DAY  1    0516

ENTER DECISION
XXX
000
  0


INSTALLATION OF TCC-7   IN MCC-6   NUMBER 12 AT SITE  2 ON RR  SYSTEM NO 1
FROM SITE  5 TO SITE  2 HAS BEEN COMPLETED

RR  SYSTEM NUMBER 1 FROM SITE  2 TO SITE  5 IS NOW OPERATING.

DAY  1    0530

ENTER DECISION
XXX
000
  0


EQUIPMENT FAILURE
    AN/TCC-7 MULTIPLEX IN MRC-102  NUMBER 21 LOCATED AT SGT MSL BN  (SITE 18)
```

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13. ABSTRACT

This thesis presents a computer assisted game, based on a current map board exercise at the U. S. Army Signal Center and School, designed to train army officers in the capabilities, organization, and deployment techniques of the Corps Signal Battalion. A team of players using the game direct a simulated signal battalion in a European tactical environment experiencing equipment failures, vehicle failures, and site attacks. The decisions made by the players are similar to those in combat and are entered by means of a remote computer terminal. These decisions include installing and deleting communications systems, connecting and disconnecting equipment, moving vehicles, and establishing communications sites. The computer, acting in the roles of battalion communications personnel, nature, and the enemy, informs the players of its actions by means of the same terminal.

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